WIND TUNNEL STUDY OF THE NEGATIVELY BOUYANT PLUME DUE TO AN LNG SPILL

by

D. E. Neff †
R. N. Meroney*
J. E. Cermak*

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R & D Associates

Marina del Rey, California

Fluid Dynamics and Diffusion Laboratory
Department of Civil Engineering
College of Engineering
Colorado State University
Fort Collins, Colorado

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*Co-principal Investigators
†Graduate Research Assistant

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ERRATA SHEET

1. All Freon data must be corrected to reflect fact that the number of moles of natural gas released at the cold field conditions exceed number of moles released during isothermal model tests. Hence the following formulae must be applied to both figures and tables,

$$x_{p_{corrected}} = \frac{x_m}{\left(x_m + (1 - x_m)\dfrac{T_{boiloff}}{T_{ambient}}\right)} = C\, x_m$$

$$K_{p_{corrected}} = \frac{K_m}{\dfrac{T_{ambient}}{T_{boiloff}}(x_m) + (1 - x_m)} = C'\, x_m$$

(Q evaluated at ambient or STP conditions)

(Typically as x_m varies from 1.0 to 0.0

C varies from ~ 1.0 to 2.7 and
C' varies from ~ 0.3 to 1.0.)

2. Above corrections are required for relevant tables in Table 10, Figures 23, 24, 25-1 to -9, and 26.

   Note also that Tables 5, 6 and 7 must also be re-interpreted.

EXECUTIVE SUMMARY

Tests were conducted in the Environmental and Meteorological Wind Tunnel Facilities to evaluate the rate of dispersion and extent of downwind hazards associated with the rupture of large liquid natural gas cryogenic storage tanks. These tests were conducted on two different dike storage areas, varying in scale from 1:666 to 1:130. Two different model release gases were used to simulate the behavior of the cold methane plume. One was a gas of molecular weight 40.6 at 70°F and the other was a gas of molecular weight 16 at -260°F. Concentration and temperature measurements, and photographic records were obtained for different wind speeds, wind directions and boiloff rates under both neutral and stable density stratification. On the basis of the experimental measurements reported herein, the following comments may be made:

1) The dimensionless concentration coefficient $\chi\bar{u}H_T^2/Q$ is a function of non-dimensional downwind distance x/H_T. This function suggests an initial decay rate in the region $x/H_T < 10$ that is less than the decay rate in the region of $x/H_T > 10$, and perhaps data should be evaluated in terms of a different length scale related to buoyancy parameters.

2) The dimensionless concentration coefficient curves asymptotically approach the slope of those given by the appropriate Pasquill diffusion category for both neutral and stable flow.

3) Visualization of similar tests for the range of model scales used (1:130 to 1:666) indicate a similar plume geometry. Concentration results of the different model scales agree to within the experimental accuracy of approximately $\pm$ 20%. Similarly identical tests also show good agreement.

4) The effect of the increased aerodynamic turbulence of the High Dike over that of the Low Dike does not appear to influence the far downwind dispersion of methane gas for a continuous release. (Note however that one expects the boiloff rate of the Low Dike to be greater than that of the High Dike for equivalent volumes of spilt LNG.)

5) Modeling of an adiabatic plume in a low humidity atmosphere by the use of a Freon 12-N_2 simulation gas at 70°F tends to give lower concentrations at the same sampling positions than that of modeling unrestricted plume behavior with the use of a He-N_2 simulation gas at -260°F. This difference was noted to be as high as 1:6.

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LIST OF SYMBOLS

Dimensions are given in terms of mass (M), length, (L), time (t), moles (n), and temperature (T)

Symbol	Definition	
A	Fraction from 0 to 1.0 (Section 2.2)	
A	Projected frontal area	$[L^2]$
a	Thermal diffusivity	$\left[L^2t^{-1}\right]$
C	Fraction from 0.5 to 2.0	
CH_4	Methane	
C_p	Specific heat capacity at constant pressure	$\left[L^2t^{-2}T^{-1}\right]$
C_p^*	Molar specific heat capacity at constant pressure	$\left[L^2Mt^{-2}T^{-1}n^{-1}\right]$
D	Tank diameter	[L]
$\mathcal{D}$	Mass diffusivity	$\left[L^2t^{-1}\right]$
d	Dike diameter	[L]
g	Gravitational acceleration	$\left[Lt^{-2}\right]$
H	Tank height	[L]
h	Dike height	[L]
$\bar{h}$	Surface heat transfer coefficient	$\left[Mt^{-3}T^{-1}\right]$
h*	Latent heat	$\left[L^2t^{-2}n^{-1}\right]$
h_c	Convective heat transfer coefficient	$\left[Mt^{-3}T^{-1}\right]$
He	Helium	
j_T	Mass flux due to thermal diffusion	$\left[Mt^{-1}L^{-2}\right]$
j_X	Mass flux due to molecular diffusion	$\left[Mt^{-1}L^{-2}\right]$
k_S	Surface thermal conductivity	$\left[LMt^{-3}T^{-1}\right]$

LIST OF SYMBOLS (continued)

Symbol	Definition	
Kr-85	Krypton-85	
L	Stability length parameter	[L]
ℓ_b	Buoyancy length scale	[L]
L.S.	Length scale	
M	Molecular weight	
m	Mass boiloff rate	$[Mt^{-1}]$
N_2	Nitrogen	
n	Moles	$[mo^1]$
p	Exponent of velocity distribution power law	
Q	Volumetric rate of gas flow	$[L^3t^{-1}]$
q	Quantity of heat	$[L^2Mt^{-2}]$
R_b	Background rate	[Counts t^{-1}]
R_{s+b}	Sample plus background rate	[Counts t^{-1}]
ΔS	Change in concentration	
S.G.	Specific gravity	
T	Temperature	[T]
$\overline{T}$	Mean temperature average across some reference layer	[T]
ΔT	Temperature difference across some reference layer	[T]
t	Time	[t]
t_b	Measurement time for background	[t]
t_s	Measurement time for sample	[t]
U	Wind speed	$[Lt^{-1}]$
$\overline{u}$	Mean wind speed averaged over the tank height	$[Lt^{-1}]$
w'	Perturbation velocity in z direction	$[Lt^{-1}]$

LIST OF SYMBOLS (continued)

Symbol	Definition	
x	Mole fraction of gas	
x	General downwind coordinate	[L]
y	General lateral coordinate	[L]
Z, z	General vertical coordinate	[L]
z_o	Surface roughness parameter	[L]
β	Coefficient of expansion due to temperature change	$[T^{-1}]$
β'	Coefficient of expansion due to concentration change	
δ	Boundary layer thickness	[L]
θ	Time of plume trajectory	[t]
ν	Kinematic viscosity	$[L^2 t^{-1}]$
ρ	Density	$[ML^{-3}]$
ρ'	Density fluctuations	$[ML^{-3}]$
$\Delta\rho$	Density difference between methane gas and air	ML^{-3}
σ_y	Standard deviation of plume distribution in the y-direction	[L]
σ_z	Standard deviation of plume distribution in the z-direction	[L]
σ_{R_s}	Standard deviation in net counting rate	[L]
ϕ	Relative humidity	
Ω	Angular velocity	$[\text{radians } t^{-1}]$
ω	Specific humidity	
χ	Volume dilution ratio	

LIST OF SYMBOLS (continued)

Dimensionless Groups

Symbol	Definition
BFM	Boundary Fourier Modulus = $\left(\frac{\bar{h}}{K_s}\right)^2 a_s\theta$
K	Dimensionless concentration coefficient
K_{ℓ_b}	Dimensionless concentration coefficient
K_T	Thermal diffusion ratio
Le	Lewis number = $a/\mathcal{D}$
Re	Reynolds number = $\frac{U_H H}{\nu}$
Ri_B	Bulk Richardson number = $\frac{g\Delta TH}{\bar{T}U_H^2}$
Ro	Rossby number = $U_H/H\Omega$
St	Stanton number = $hc/\rho U_H C_P$
$\$_y$	Stability number = $B\Delta T/B'\Delta S$

Subscripts

a	Air
B	Boiling point
g	Gas
H	At tank height
L	Liquid
m	Model
min	minimum
mx	maximum
p	prototype
wv	Water Vapor

1.0 INTRODUCTION

The objective of this study was to evaluate the rate of dispersion and extent of downwind hazards associated with the rupture of large liquid natural gas (LNG) cryogenic storage tanks. In particular the use of diked storage areas to reduce the extent of potential damage was examined. It is estimated that in the 1980 time period 0.04 trillion cubic meters per year of natural gas will be supplied in the form of LNG. Thus safety at LNG facilities is of utmost importance to the gas industry and the public. The hazards associated with LNG release are fire and thermal radiation from such fires. If ignition does not occur immediately during an accidental LNG release, the boiling LNG produces vapors which are mixed with ambient air and transported downwind. This cloud is potentially flammable until the atmosphere dilutes the gas mixture below the lower flammable limit (LFL) (a local concentration for methane below 5 percent by volume). If the flow from a rupture in a full LNG storage tank could not be stopped for some reason, 28 million cubic meters (1BSCF) of LNG vapor would be released in 80 minutes.[1]

As a result of concern over such problems associated with the transportation and storage of LNG the gas and petroleum industries have sponsored a series of previous studies on cryogenic spills of LNG and other liquids such as liquid oxygen and liquid ammonia on both land[1] and water.[2,3] Figure 1 shows the peak concentration correlation with distance from spill from reference 1. Measurements of plume dispersion downwind of large and small spills have also been incorporated into a variety of prediction models.[1,4,5] Unfortunately it appears that authors of these models interpreted available measurements quite differently.[6,7,8] In addition predictions are very sensitive to source type, boiloff rate, dispersion coefficient data, weather conditions, and expected peak to mean concentration ratio.[9]

Further tests to illuminate the missing physics of LNG spill behavior would be appropriate. Wind tunnel laboratory measurements permit a degree of control of safety, meteorological, source and site variables not often feasible or economic at full scale.

There exists in the literature descriptions of a variety of different wind tunnel model studies on the dispersion of plumes in the atmosphere.[10,11,12,13,14,15,16,17,18] These studies are significant in that their results have been essentially confirmed by either direct prototype measurements or by the absence of the gases or dusts that the study was directed to prevent. References 11, 12, 14 and 15 incorporate such comparisons within their text. Reference 10 has been compared with prototype measurements at the National Reactor Testing Station in southeast Idaho.[19] Agreement of the diffusion concentration results were very satisfactory. Martin[15] favorably compared his wind tunnel study measurements about a model of the Ford Nuclear Reactor at the University of Michigan with prototype measurements. Finally, Munn and Cole[20] have taken diffusion measurements on a power station complex at the National Research Council, Ottawa, Canada, to confirm the general entrainment criteria suggested by the model studies of Davies and Moore.[12]

The purpose of this study is to provide basic information on the structure of vapor plumes resulting from LNG spills on land for a realistic range of meteorological variables, source variables and site features. Small scale models of the tank-dike complex were placed in a meteorological wind tunnel capable of simulating the appropriate meteorological conditions. The mean concentrations of LNG vapor at different downwind stations determined by sampling concentrations of a tracer gas (Propane or Krypton 85) released from the LNG dike area. A Freon 12-N_2 gas mixture and a cooled He-N_2 gas mixture were both used to simulate the LNG vapor. Overall plume geometry and behavior was obtained by photographing plumes which were made visible by the addition of titanium oxide.

The general scope includes determination of the distance downwind to the LFL and how the plume behavior is affected by dike configuration, boiloff rate, wind direction, wind speed and thermal stratification. A wide range of meteorological conditions can be simulated in the Meteorological Wind Tunnel of the Fluid Dynamics and Diffusion Laboratory (FDDL) at Colorado State University. The conditions simulated for this study included the abiabatic lapse rate (thermally neutral flow) and the ground based inversion (stably stratified) situation.

The modeling criteria necessary to simulate atmospheric motions over such a site are presented in Section 2. Details of the model construction and the experimental equipment are described in Section 3. Finally, Sections 4 and 5 discuss the results obtained and their significance.

This report is supplemented by a motion picture (in color) which shows the plume behavior for two different dike configurations under different boiloff rates and meteorological conditions. A set of these pictures were taken for two different simulation gases: one of a Freon 12-Nitrogen mixture @ 70° F and one of a Helium-Nitrogen mixture at -260°F.

2.0 SIMULATION OF ATMOSPHERIC AND PLUME MOTION

The use of a wind tunnel for model tests of gas diffusion in the atmosphere is based upon the concept that non-dimensional concentration coefficients will be the same at contiguous points in the model and the prototype and will not be a function of the length scale ratio. Concentration coefficients will only be independent of scale if the wind tunnel boundary layer is made similar to the atmospheric boundary layer by satisfying certain similarity criteria. These criteria are obtained by inspectional analysis of physical statements for conservation of mass, momentum, and energy. Detailed discussions have been given by Halitsky,[12] Martin,[15] and Cermak.[22,23] Basically the model laws may be divided into requirements for geometric, dynamic, thermic, and kinematic similarity. In addition, similarity of upwind flow characteristics and ground boundary conditions must be achieved.

For the study of LNG spills, geometric similarity is satisfied by undistorted models of the different LNG tank and dike facilities with length ratios varying from 1:130 to 1:666. The 1:130 scale models were used to observe the near wake region by visualization techniques. The smaller models were used to observe the lateral spreading effects of the dense plume without any possible wall effects. A 1:200 model size was chosen for the majority of measurements as it did not constrain the plume's character too severely, yet provided a boundary layer equivalent to 500-700 feet for the atmosphere and minimized wind tunnel blockage. (The ratio of projected area to the area of the wind tunnel cross section should not exceed five percent. The 1:200 scale model of the LNG tank and dike facility produced a blockage of approximately two percent in the Meteorological Wind Tunnel.)

2.1 MODELING THE ATMOSPHERIC SURFACE LAYER

2.1.1 Modeling the Neutral Atmosphere

Building and building complexes produce nonuniform fields of flow which perturb the regular upstream atmospheric wind profiles. Around each building a boundary layer exists in which the velocity is zero at the surface but increases rapidly to a relatively constant value a short distance from the building wall. Outside of the boundary layer and downstream there exists a region of low velocities and pressures called the cavity. In this region circulations are such that flow may actually reverse with respect to the upstream winds. Surrounding the cavity but extending further downstream is a parabolic region called the wake in which the presence of the building is still evident in terms of deviations of velocity, turbulence, and pressure from conditions found in the upstream atmospheric boundary layer.

The formation of the wake and cavity regions are associated with a phenomena called boundary-layer separation. Under certain conditions the boundary layer actually detaches and enters the flow streaming about the building. This may occur on a curved surface if the pressure increases due to a decelerating flow field. The separated boundary layer forms a sheet which completely surrounds the cavity region which contains relatively stagnant fluid. The extent of the wake and cavity region behind an LNG tank facility is of large importance as it is here that the initial rate of dispersion of the LNG vapor is dictated.

When interest is focused on modeling the atmospheric motion over a building complex in a thermally neutral atmosphere the following variables are of primary significance:

ρ_a = density of ambient air

ν = kinematic viscosity of ambient air

U_H = speed of ambient wind at tank height

H = tank height

h = dike height

d = dike diameter

δ = thickness of planetary boundary layer

z_o = roughness heights for upwind surface

Ω = local angular velocity component of earth

Grouping the independent variables into dimensionless parameters with ρ_a, U_H, and H as reference variables yields:

$\frac{\delta}{H}$, $\frac{d}{H}$, $\frac{h}{H}$, $\frac{z_o}{H}$ - Various length scale ratios

$\frac{U_H}{H\Omega}$ - Rossby number

$\frac{U_H H}{\nu}$ - Reynolds number

For the model atmosphere to be completely representative of the full-scale atmosphere, the values of these six dimensionless numbers plus similarity in approach flow velocity and turbulence profiles should be the same for model and prototype.

The laboratory boundary-layer-thickness parameter δ/H was made close to that for the atmosphere. A value for this ratio of at least 3.0 was established for the highest tank. Equality of the effects of the surface parameter z_o/H for model and prototype was achieved through geometrical scaling of the building complex and similarity of the upwind velocity profile. Likewise the dike parameters d/H and h/H were equal for model and prototype.

Dynamic similarity is achieved in a strict sense if a Reynolds number $\frac{U_H H}{\nu}$ and a Rossby number $\frac{U_H}{H\Omega}$ for the model is equal to its counterpart for the atmosphere. The model Rossby number cannot be made equal to the atmospheric value. However, over the short distances considered (up to 6000 ft), the Coriolis acceleration has little influence upon the flow. Accordingly, the standard practice is to relax the requirement of equal Rossby numbers.[23]

Kinematic similarity requires the scaled equivalence of streamline movement of the air over prototype and model. It has been shown by Golden[10] that flow around geometrically similar sharp-edged buildings at ambient temperatures in a neutrally stratified atmosphere should be dynamically and kinematically similar when the approaching flow is kinematically similar. This approach depends upon producing flows in which the flow characteristics become independent of Reynolds number if a lower limit of the Reynolds number is exceeded. For example, the resistance coefficient for flow in a sufficiently rough pipe as shown in Schlicting[24] (p. 521) is constant for a Reynolds number larger than 2×10^4. This implies that surface or drag forces are directly proportional to the mean flow speed squared. In turn, this condition is the necessary condition for mean turbulence statistics such as root-mean square value and correlation coefficient of the turbulence velocity components to be equal for the model and the prototype flow.[21,23]

Golden, as cited by Halitsky,[10,21] studied effluent discharged into the air stream from a vent flush with the surface of a cube. The non-dimensional concentration isopleths above the cube showed only slight variations over the entire range of Reynolds number tested from 3000 to 57,000. Maximum concentrations on the roof itself were invarient for Reynolds numbers greater than 11,000.

Cermak[22] cited that this same criterion may be applied to smooth surfaces if the points of separation on the model and prototype are made similar by modification of the model's surface roughness characteristics. For the present study this minimum Reynolds number criterion was relaxed in light of the fact that Golden's results were obtained in a near uniform flow and it is believed that for a turbulent shear flow this minimum Reynolds number criterion would be significantly lower than 11,000. The range of Reynolds numbers for the 1:200 scale models ranged from 2,700 to 11,500. Correlation tests of flow about the Rock of Gibraltar, flow over Pt. Arguello, California, and flow over San Nicolas Island, California, may be cited as examples of large Reynolds number flows which have been modeled successfully in a wind tunnel.[25,26,27]

The need for scaling of the atmospheric mean wind profile was demonstrated by Jensen.[28] Substitutions of a uniform velocity profile for a logarithmic profile results in threefold variation in the dimensionless pressure coefficient downstream of a model building. Such variance in the pressure fields indicates a strong effect of the upstream wind profile on the kinematic behavior of the fluid near the building complex. One of the few tunnels currently capable of generating a turbulent boundary layer thick enough for a 1:200 model scale is the Meteorological Wind Tunnel at Colorado State University. Other investigators have attempted to generate logarithmic profiles in short tunnels by inserting special grids upstream of the test section; however, this technique normally creates a nontypical turbulence field which decays rapidly downstream.

For this study the simulated approach mean-wind conditions were described by an exponent of the velocity distribution power law of $p = .23$ to $p = .34$. This was found to be adequate for an upstream fetch of hedges, trees, or city suburbs for $p = .23$ and of cities for $p = .34$.[23] Approach velocity was modified by suitably adjusting the roughness condition upwind of the model such that the measured velocity confirmed with the following relation.

$$\frac{U(z)}{U_H} = \left(\frac{z}{H}\right)^p$$

To summarize, the following scaling criteria were applied for the neutral boundary layer situation:

1) $Re = \frac{U_H H}{\nu}$ relaxed

2) $Ro = \frac{U_H}{H\Omega}$ relaxed

3) $\left(\frac{\delta}{H}\right)_m \approx \left(\frac{\delta}{H}\right)_p$

$\left(\frac{D}{H}\right)_m = \left(\frac{D}{H}\right)_p$

$\left(\frac{h}{H}\right)_m = \left(\frac{h}{H}\right)_p$

$\left(\frac{z_o}{H}\right)_m = \left(\frac{z_o}{H}\right)_p$

4) Similarity in approach flow characteristics was maintained by adjustment of p in the relation

$$\frac{U(z)}{U_H} = \left(\frac{z}{H}\right)^p$$

2.1.2 Modeling the Stratified Atmosphere

When a warm air mass layers on top of a cold air mass what is known as an inversion develops. Yang and Meroney[29] found that inversion stratification causes smaller transverse spread in a diffusing plume behind a simple model building. The stratification "freezes" the plume growth in the vertical direction once aerodynamic mixing has subsided.

When thermal stratification is present, additional requirements must be met to achieve similarity of the atmospheric motion. These requirements have been discussed previously by Cermak,[30] Yamada and Meroney,[31] and SethuRaman and Cermak.[32] Similarity of the stably stratified flow approaching the LNG facility can be achieved by requiring equality of the bulk Richardson number

$$Ri_B = \frac{\Delta T}{\overline{T}} \frac{H}{U_H^2} g$$

for the laboratory flow and the atmosphere. In this expression, ΔT is the difference between mean temperature (potential temperature for the atmosphere) at the surface and at the height H, $\overline{T}$ is the average temperature over the layer of depth H and g is the acceleration due to gravitational attraction.

For a strong stably stratified flow it is expected that the power-law coefficient for the velocity profile will increase in magnitude. Sutton reports measurements over an English airfield of coefficient values of 0.44, 0.59, 0.63, 0.62 and 0.77 when the temperature change over a 400 foot depth was 2-4, 4-6, 6-8, 8-10 and 10-12^{o}F, respectively.[33] Panofsky, et al., have produced a nomogram from diabatic wind profile measurements for the power-law coefficient variation versus surface roughness, z_o, and stability length parameter, L, which suggests values for strongly stable situations between 0.25 to 0.6.[34]

2.2 MODELING OF PLUME MOTION

Grouping independent variables which govern the motion of an LNG vapor plume into dimensionless parameters with ρ_a, U_H, and H as reference variables yields:

$\dfrac{\rho_a U^2_H}{g(\rho_a - \rho_g)H}$ - Modified Froude number

$\dfrac{\rho_g Q^2}{\rho_a U_H^2 H^4}$ - Momentum ratio

$\dfrac{\rho_g - \rho_a}{\rho_a}$ - Gas density ratio

$\dfrac{Q}{U_H H^2}$ - Non-dimensional spill rate where the previously undefined independent variables are

ρ_g = density of methane gas

Q = boiloff rate of methane

It is possible to obtain full-scale values of these dimensionless parameters by reducing the reference velocity, U_H, to very low values (of the order of 0.7 ft/s to simulate a 10 ft/s full-scale wind). In some cases investigators modify the density ratio $(\rho_a - \rho_g)/\rho_a$ to permit the use of larger and more convenient values of U_H (Hall[35]). Unfortunately this also modifies inertial effects and volume dilution rates so this modification was not performed on this study.

Previous experiments by Hoot and Meroney,[36] Bodurtha,[37] Van Ulden,[5] and Boyle and Kneebone[38] have confirmed that the Froude number is the parameter which governs plume spread rate, trajectory, plume size and entrainment when gases remain negatively buoyant during their entire trajectory. In the case of spills of LNG, buoyancy of the plume will be a function of both mole fraction of methane and temperature. Thus, depending upon the relative rate of entrainment of ambient gases versus rate of thermal transport from surrounding surfaces the state of buoyancy may vary from negative to positive.

To clarify this point consider the case of adiabatic mixing of the subject gas with ambient gases together with a fractional transport of thermal energy to a plume. A one-dimensional mixing model including considerations of conservation of energy and mass plus thermodynamic definitions of mixture properties produces

$$S.G._{mixture} = \{x \frac{M_g}{M_a} + (1-x)\ (1+\omega)/(1+\omega \frac{M_a}{M_{wv}})\}$$

$$\cdot \{x \frac{c^*_{p_g}}{c^*_{p_a}} + (1-x)\ (1+\omega \frac{M_a}{M_{wv}} \frac{c^*_{p_{wv}}}{c^*_{p_a}})/(1+\omega \frac{M_a}{M_{wv}})\}$$

$$\div \{x \frac{c^*_{p_g} T_g}{c^*_{p_a} T_a} + (1-x)(1+\omega \frac{M_a}{M_{wv}} (\frac{c^*_{p_{wv}}}{c^*_{p_a}} + \frac{h^*_{wv}}{c^*_{p_a} T_a}))/$$

$$(1+\omega \frac{M_a}{M_{wv}}) + \frac{q}{n_a c^*_{p_a} T_a}\}$$

$$\frac{T}{T_a} = \{xc^*_{p_g} \frac{T_g}{T_a} + (1-x)(c^*_{p_a} + c^*_{p_{wv}}\ \omega \frac{M_a}{M_{wv}})/(1 + \omega \frac{M_a}{M_{wv}})$$

$$+ (\omega \frac{M_a}{M_{wv}}\ (1-x) \frac{h^*_{wv}}{T_a})/(1 + \omega \frac{M_a}{M_{wv}}) + \frac{q}{nT_a}\}$$

$$\div \{x_g\ c^*_{p_g} + (1-x)(c^*_{p_a} + c^*_{p_{wv}}\ \omega \frac{M_a}{M_{wv}})/(1 + \omega \frac{M_a}{M_{wv}})\}$$

where S.G. is the specific gravity of the mixture, x is mole fraction of spilled gas, M is molecular weight, c^*_p is the molar specific heat capacity, n is moles, ω is specific humidity, and subscripts g, a and wv are spilled gas, air, and water vapor respectively. If one in addition assumes a linear decrease in plume temperature with mole fraction, a constant heat transfer coefficient, and a total thermal deficit equal to $n_g c^*_{p_g} (T_a - T_g)$, then

$$\frac{q}{n_a c^*_{p_a} T_a} = A\left(\frac{c^*_{p_g}}{c^*_{p_a}}\right)\left(1 - \frac{T_g}{T_a}\right)(1-x)(x)$$

where A is a fraction between 0 and 1.0. Finally if one may assume ω, $\omega\, M_a/M_{wv}$, and $\omega\, M_a/M_{wv}\; c^*_{p_{wv}}/c^*_{p_a}$ are small with respect to $\omega\, M_a/M_{wv}\; h^*_{wv}/c^*_{p_a} T_a$, then

$$S.G._{mixt} \cong \left\{x\left(\frac{M_g}{M_a} - 1\right)+1\right\} \cdot \left\{x\left(\frac{c^*_{p_g}}{c^*_{p_a}} - 1\right)+1\right\}$$

$$\div \left\{x\left(\frac{c^*_{p_g} T_g}{c^*_{p_a} T_a} - \omega \frac{h^*_{wv} M_a}{c^*_{p_a} T_a M_{wv}} - 1\right) + \omega \frac{M_a}{M_{wv}} \frac{h^*_{wv}}{c^*_{p_a} T_a}\right.$$

$$\left. + 1 + A \frac{c^*_{p_g}}{c^*_{p_a}}\left(1 - \frac{T_g}{T_a}\right)(1-x)x\right\}$$

$$\frac{T}{T_a} = \left\{x\left(\frac{c^*_{p_g}}{c^*_{p_a}} - \omega \frac{h^*_{wv} M_a}{c^*_{p_a} T_a M_{wv}} - 1\right) + \omega \frac{M_a}{M_{wv}} \frac{h^*_{wv}}{c^*_{p_a} T_a}\right.$$

$$\left. + 1 + A \frac{c^*_{p_g}}{c^*_{p_a}}\left(1 - \frac{T_g}{T_a}\right)(1-x)(x)\right\}$$

$$\div \left\{x\left(\frac{c^*_{p_g}}{c^*_{p_a}} - 1\right) + 1\right\}$$

This simple model assumes all water vapor entrained is condensed and ignores the heat of solidification as a mean heat addition. Liquid water should re-evaporate only after $T/T_a > .93$.

Sample computations for methane spills suggest qualitative behavior as shown in Figure 2. If the relative humidity is zero, depending upon A (heat transfer rate) the behavior of buoyancy forces will vary markedly with dilution. Thus it is important to model not only the initial Froude number of a plume but its characteristic variation with dilution also. Room temperatures of N_2-Freon-12 mixtures will behave like the A = 0 case, and a release of nitrogen cooled to 217^oK will perform similar to a marginally buoyant methane spill (A = 1/3). For A = 0 but finite values of humidity it is seen in Fig. 2 that humidities greater than 60 percent may produce marginally buoyant plumes as a result of adiabatic mixing. A mixture of helium and nitrogen ($x_{He} = 0.5$, $x_{N_2} = 0.5$) adjusted to produce a molecular weight equal to that of methane, which is cooled to methane boiloff temperatures (112^oK) should simulate the variable Froude number characteristic but with a nonflammable gas.

Consideration of the heat transfer conditions suggests that surface heat transport from the ground will be a function of the Boundary Fourier Modulus function

$$\mathrm{BFM} = \left(\frac{\overline{h}}{k_s}\right)^2 a_s\theta = \frac{\text{Plume time over surface}}{\text{Time constant to change surface temperature}}$$

$\bar{h}$ = surface heat transfer coefficient

k_s = surface conductivity

a_s = surface diffusivity

θ = time of plume trajectory = x/u.

Examination of the range of this term suggests that for field and wind tunnel configurations BFM << 1.0; thus, it is sufficient to maintain the surface temperature in the laboratory constant. Since the turbulence characteristics of the flow are dominated by roughness, upstream profile shape, and stratification one expects that the Stanton number in the field will equal that in the model, i.e., $St_m = St_p$, and heat transfer rates in the two cases should be in proper relation to plume entrainment rates.

To summarize, the following scaling criteria were applied to the motion of the LNG vapor plume:

1) $\left(\frac{Q}{U_H H^2}\right)_m = \left(\frac{Q}{U_H H^2}\right)_p$ Non-dimensional spill equality

2) $\left(\frac{\rho_g - \rho_a}{\rho_a}\right)_m = \left(\frac{\rho_g - \rho_a}{\rho_a}\right)_p$ Density ratio equality

3) $\left(\frac{\rho_g Q^2}{\rho_a U_H^2 H^4}\right)_m = \left(\frac{\rho_g Q^2}{\rho_a U_H^2 H^4}\right)_p$ Momentum ratio equality

4) $\left(\frac{\rho_a U_H^2}{g(\rho_a - \rho_g)H}\right)_m = \left(\frac{\rho_a U_H^2}{g(\rho_a - \rho_g)H}\right)_p$ Froude No. equality

Tables 1 and 2 give the values of the pertinent scaling criteria for the prototype and model respectively.

3.0 DATA ACQUISITION AND ANALYSIS

Measurements in wakes require considerable care, both in their acquisition and in their interpretation. In this section the methods used to make measurements and the techniques used in converting directly measured quantities to meaningful physical quantities are discussed. Attention is drawn to the limitations in the techniques in an attempt to prevent misinterpretation or misunderstanding of the results to be presented in the next section. Many of the methods used are very common and need little explanation. However, particular attention is drawn to Kr-85 and Hydrocarbon systems used to measure mean concentration. These systems were developed during the course of this research at Colorado State University for high resolution measurements of concentration.

3.1 THE WIND TUNNEL FACILITY

The majority of the experiments were performed in the Meteorological Wind Tunnel (MWT) shown in Figure 3. This wind tunnel, especially designed to study atmospheric flow phenomena, incorporates special features such as an adjustable ceiling, a rotating turntable, temperature controlled boundary walls, and a long test section to permit adequate reproduction of micrometeorological behavior. Mean wind speeds of 0.2 to 130 ft/sec (0.14 to 90 mi/hr) in the MWT can be obtained. Boundary-layer thickness up to four feet can be developed "naturally" over the downstream 20 feet of the MWT test section. Thermal stratification in the MWT is provided by the heating and cooling systems in the section passage and the test section floor. The flexible test section roof on the MWT is adjustable in height to permit the longitudinal pressure gradient to be set at zero. A set of vortex generators were installed two feet downwind of the entrance to give the simulated boundary layer an initial impulse of growth. From 6 to 40 ft a set of 12 roll-bond aluminum panels were placed on the tunnel floor. These panels were connected to the facility refrigeration system and cooled to approximately 32°F. Fillets were installed in the bottom tunnel corners to cover the plumbing connections and reduce resulting wake turbulence. From 40 ft to the end of the test section a permanently installed set of cooling panels were used to also lower the aluminum floor temperature to a level of 32°F. The free stream temperature was raised to a level near 115°F as prescribed by the Bulk Richardson number. The Facility is described in detail by Plate and Cermak[39].

The Environmental Wind Tunnel (EWT) shown in Fig. 4 was used for part of the neutral flow study. This wind tunnel, specially designed to study atmospheric flow phenomena, incorporates special features such as adjustable ceiling, rotating turntables, transparent boundary walls, and a long test section to permit adequate reproduction of micrometeorological behavior. Mean wind speeds of 0.2 to 50 ft/sec (0.14 to 40 mi/hr) in the EWT can be obtained. In the EWT boundary layers three feet thick over the downstream 20 ft can be obtained with the use of the vortex generators at the test section entrance. The flexible test section roof on the EWT is adjustable in height to permit the longitudinal pressure gradient to be set at zero.

3.1.1 Test Configuration in the MWT

Vortex generators were installed at the tunnel entrance together with an initial roughness to accelerate the preliminary growth of the modeled boundary layer. The 1:200 scale LNG tank models were constructed to represent a swath 600 feet to the right and left of the wind orientation chosen. The floor of the tunnel was equipped with up to 50 taps arranged in sampling arrays to measure ground level and vertical profile concentrations. A typical example of the sample array used is shown in Figure No. 5.

3.2 MODEL

Two different LNG tank and dike facilities were modeled, one entitled the Representative High Dike, the other the Representative Low Dike. The drawings indicating full scale dimensions were supplied by R & D Associates and are presented as Figures 6 and 7. For the representative high dike three different model scales were made - 1:500, 1:200, and 1:130. For the representative low dike two different model scales were made - 1:666 and 1:200. In addition to these five models, which were constructed from lucite and styrafoam, there were two models of the 1:200 scale made of steel. These two steel models were made in the form of liquid nitrogen reservoirs so that a release gas of Helium and Nitrogen at -260^{o}F would not be preheated during flow within the model. Figure 8 shows a schematic of the construction of these models.

Two different simulation gases were premixed and stored in large, high pressure tanks. One was a mixture of 13% Freon, 5% Propane, and 82% Nitrogen which was released at room temperature. The other was a mixture of 52% Helium, 48% Nitrogen, and trace Krypton-85 which was released at -260^{o}F. These two gas mixtures had molecular weights of 40.6 and 16 respectively. Depending upon the test being undertaken, one of these gas mixtures was allowed to flow from the model, simulating the exit flow rate and buoyancy effects due to the density difference between LNG vapor and the ambient atmosphere. This gas was metered by Fischer-Porter precision flow rators which were adjusted for pressure, temperature, and molecular weight effects as necessary. Figures 9 and 10 show an outline of the two different gas release systems.

For all of the tests involving concentration data the release gas flow rates were held at different constant values. For flow visualization the variable boiloff nature of the plume was also simulated in addition to the constant flow rate tests. Equations for the boiloff of methane with respect to time for the different full scale cases were provided by R & D Associates.[9] Graphs of the boiloff vs time for both full scale and 1:200 scale are provided in Figures 11 and 12 for both the high and low dikes respectively. The mechanism that was used to control the time dependent flow rate through the 1:200 scale model is shown in Figure 13.

3.3 FLOW VISUALIZATION TECHNIQUES

Smoke was used to define plume behavior over the LNG Facility. The smoke was produced by passing the simulation gas mixture through a container of titanium tetrachloride located outside the wind tunnel and transported through the tunnel wall by means of a tygon tube terminating at the dike inlet within the model. The plume was illuminated with arc-lamp beams. A visible record was obtained by means of pictures taken with a Speed Graphic camera utilizing Polaroid film for immediate examination. Additional still pictures were obtained with a Hasselblad camera. Stills were taken with camera speeds of approximately one second. A series of color motion pictures were also taken with a Bolex motion picture camera mounted on a movable dolly which was traversed the length of the tunnel parallel to the plume trajectory at the average wind speed.

3.4 WIND PROFILES AND TEMPERATURE MEASUREMENTS

A Datametrics Series 800-L Linear Flow Anemometer was utilized to measure the upstream velocity profiles in both the neutrally and stably stratified flow fields. This instrument is accurate to within 2% of its reading.

Measurement of temperature was made with a miniature thermistor (Fennal glass coated bead) system constructed by Yellowsprings, Corp. (YSI Model 42 SC).

3.5 GAS TRACER TECHNIQUE FOR FREON-AIR SIMULATION

After the flow in the tunnel was stabilized, a mixture of propane, Freon 12 and Nitrogen of molecular weight 40.6 was released from the model dikes at the required rate. Samples of air were withdrawn from the sample points isokinetically and analyzed. The flow rate of propane mixture was controlled by a pressure regulator at the supply cylinder outlet and monitored by a Fischer and Porter precision flow meter. The sampling and detection systems are shown in Figure 14.

3.5.1 Analysis of Data

Propane is an excellent tracer gas in wind tunnel dispersion studies. It is a gas that is readily obtainable and whose presence may be detected utilizing flame ionization and gas chromatography techniques.

The procedure for analyzing the samples was as follows:

1) 2 cc volumes of the source gas, tunnel background air, and sample gases from within the plume were introduced into the Flame Ionization Detector individually.

2) The output from the electrometer was integrated for each of these gases and the readings in volt-seconds were recorded.

3) The correction for background level was performed on the sample gases. $(\text{volt-sec sample})_{\text{corrected}} = (\text{volt-sec sample}) - (\text{volt-sec background})$

4) The percentage of source gas remaining at each sample point is expressed as percent methane.

$$(\%\ \text{methane}) = \frac{(\text{volt-sec sample})_{\text{corrected}} \times (100)}{(\text{volt-sec source})}$$

5) The dimensionless concentration parameter $(\chi \bar{u} H^2/Q)_m$ was calculated for each sampling point knowing that

$\chi = (\%\ \text{methane}) \div 100$

$\bar{u}$ = mean speed of wind averaged over the tank height

H = tank height

Q = source gas flow rate

subscript m = under model conditions

6) Since the dimensionless concentration parameters are equivalent between model and prototype, one may calculate percent methane at points in the field under any condition with an equivalent Froude

number, density ratio, and dimensionless source ratio and similar approach velocity and Richardson number profiles. For example, say that a boiloff of 944.6 lbm/sec of methane under a mean wind speed of 22 ft/sec over a tank height of 129 ft is of interest. Then for a point where

$\left(\frac{\chi \bar{u} H^2}{Q}\right)_m = 1.0$ and $Q_p = \frac{944.6}{.1047} = 9021\ ft^3/sec$ where ρ_{CH_4} gas @ -260^oF = $.1047\ lbm/ft^3$.

$$\%\ \text{methane} = 100\ \chi_p = \frac{\chi \bar{u} H^2}{Q}\Big|_m \times \frac{Q}{\bar{u} H^2}\Big|_p \times 100$$

$$= 1.0 \times \frac{9021}{22(129)^2} \times 100 = 2.5.$$

3.5.2 Errors in Concentration Measurement

The reference state for the flame ionization detector is established by a constant carrier flow of nitrogen. At this baseline level the output from the electrometer was set at zero. When a sample passes through the detector the output from the electrometer rises to a level proportional to the amount of tracer gas flowing through the detector. Since the chromatograph used features a temperature control on the flame and electrometer there is very low drift. The integrator circuit is designed for linear response over the range considered. A total system error can be evaluated by considering the standard deviation found for a set of measurements where a precalibrated gas mixture is monitored. For a gas of ~ 100 ppm propane ± 1 ppm the average standard deviation from the electrometer was two percent.

Since the source gas was premixed to the appropriate molecular weight and repetitive measurements were made of its source strength the confidence in source strength concentration is similar. The flow rate of the source gas was monitored by Fischer-Porter Flowmeters which are expected to be accurate to ± two percent including calibration and scale fraction error. The wind tunnel velocity was constant to ± 20 percent at such low settings. Hence the cumulative confidence in the measured values of $X\bar{u}H^2/Q$ will be a standard deviation of about ± 20 percent, whereas the worst cumulative scenario suggests an error of no more than ± 30 percent.

The lower limit of measurement is imposed by the instrument sensitivity and the background concentrations of hydrocarbons in the air within the wind tunnel. Background concentrations were measured and subtracted from all measurements quoted herein; however, a lower limit of 1 to 2 ppm of propane is available as a result of background methane levels plus previous propane releases. An upper limit for propane with the instrument used is 10 percent propane by volume; however, chromatograph columns are necessary to avoid overwhelming the detector when propane concentrations are above 5-6 percent. A recent report on the flame ionization detector for sampling gases in atmospheric wind tunnels prepared by Dear and Robins[40] arrives at similiar figures.

3.6 GAS TRACER TECHNIQUE FOR HELIUM-NITROGEN SIMULATION

Since propane liquifies at temperatures well above -260°F it was excluded as a possible tracer for this simulation gas. Krypton-85 remains a gas at these temperatures if it is present at a very low partial pressure; therefore it was decided to use Krypton-85 as a tracer.

After the flow in a tunnel was stabilized a mixture of Kr-85, Helium, and Nitrogen of molecular weight 16 was released from a model dike at the required rate. Samples of air were withdrawn from the sample points on the wind tunnel floor and analyzed. The flow rate of Kr-85 mixture was controlled by a pressure regulator at the supply cylinder outlet and monitored by a Fischer and Porter precision flow meter. Source concentration was from .0101 to .0125 μc_i/cc of Kr-85, a beta emitter (half lifetime = 10.6 years). The sampling and detection systems are shown in Fig. 15.

3.6.1 Analysis of Data

Krypton-85 is a radioactive noble gas with a half life of 10.6 years. The gas decays by emission of beta particles with small amounts of gamma rays. The gas has many advantages over the other tracers used in wind tunnel dispersion studies. It is diluted with air about a million times before use, and as such, has properties very similar to those of air. Its detection procedure is fairly simple and direct.

The procedure for analyzing the concentration data was as follows:

1) 100 cc volumes of the source gas, tunnel background air, and sample gases from within the plume were introduced into the jacketed G.M. tubes individually.
2) The counts per minute of each of these gases were recorded.
3) These counts were transformed into concentration values by the following step:[-]

$$\text{Cpm}^* = \text{Cpm} - \text{Background (Cpm)}$$

$$(\mu\mu \text{ Curie/cc}) = \text{Cpm}^* \times \text{Counting Yield (p Curie/cc/Cpm)}$$

[-] p Curie: pico curie (10^{-12} curie)

4) For counts over 1,000 a dead time correction[Δ] had to be applied to the readings, and in this case the correction is,

$$\text{Cpm}^* = \text{Cpm} - \text{Background}$$

$$\text{Cpm}^* = \frac{\text{Cpm}^*}{1 - 2.00 \times 10^{-6} \times \text{Cpm}^*}$$

$$(\text{p Curie/cc}) = \text{Cpm}^* \times \text{Counting Yield}$$

5) The percentage of source gas remaining at each sample point is expressed as percent methane.

$$(\%\ \text{methane}) = \frac{(\mu\mu\ \text{Curie sample}) \times 100}{(\mu\mu\ \text{Curie Source})}$$

6) The dimensionless concentration parameter $(\chi\bar{u}\,H^2/Q)_m$ was calculated for each sampling point as before.

3.6.2 Errors in Concentration Measurements

Where data is obtained with a scaler counter, the apparent activity of a radioactive source is found by subtracting the background rate from the observed sample-plus-background rate. The background rate is measured separately and has an uncertainty of its own due to random radioactive sources.

If the background is present, the standard deviation in the net counting rate σ_{R_s} for a sample is

$$\sigma_{R_s} = \left(\frac{R_{s+b}}{t_s} + \frac{R_b}{t_b}\right)^{1/2}$$

[Δ] The time taken for the positive space charge to move sufficiently far from the anode for further pulses to occur.

where R_{s+b} is the observed sample-plus-background rate, R_b is the background rate, t_s and t_b are the measurement time for the sample and background, respectively. The standard deviation in the sample rate depends, then, upon both the time for sample measurement and that for the background-rate measurement. When R_{s+b} is large in comparison with R_b, a long background measurement is not needed to make the error contribution from the background rate negligible. On the other hand, when R_{s+b} is comparable to R_b, both t_s and t_b must be very long for small values of σ_{R_s}. In the present experiments, an effort was made to keep the probable errors in concentration measurements within 10 percent. For this reason the sample counting time and background counting time were manipulated with this end in view. More detailed information on errors in radioactivity measurements can be found in Yang and Meroney.[29]

4.0 TEST PROGRAM

The test program consisted of (1) a qualitative study of the flow field around the different tank and dike facilities by visual observation of the plume released from the dike area; and (2) a quantitative study of gas concentrations produced by the release of a tracer from the dike area. The test conditions are summarized in Table 2. Both of these qualitative and quantitative studies were performed with two different model simulation gases. One was a Freon-Nitrogen gas mixture at $70^{o}F$ (S.G. 1.4) to model the characteristics of an adiabatic plume in a low humidity atmosphere. The other was a Helium-Nitrogen gas mixture at $-260^{o}F$ (S.G. 1.4) to model plume behavior without placing the above restrictions on heat transfer rate and atmospheric conditions. For a more complete description of simulation gas characteristics refer to Section 2.2.

Downwind distances refer to lengths converted from model to prototype as measured from the center of the LNG tank. Unless otherwise noted, the term wind velocity refers to the velocity in the undisturbed free stream at an equivalent height of 130 feet, a velocity at any reference height is available by referring to the appropriate velocity profile (Figures 16-19).

5.0 TEST RESULTS

5.1 CHARACTERISTIC OF FLOW

All the concentration and most of the visualization experiments were carried out in the MWT over the range of conditions shown in Table 2. The atmospheric boundary layer was modeled to produce velocity and temperature profiles that may be found typically under prototype conditions.

For the neutral flow situation two different velocity profiles were obtained, one for the low wind speed case (Figure 16) and one for the high wind speed case (Figure 17). These model velocity profiles reproduce a power-law behavior with exponents of 0.34 and 0.23 respectively. These exponents adequately represent flow over a small city for the 0.34 exponent and flow over grasslands for the 0.23 exponent.

For the stable flow situation two different sets of velocity and temperature profiles were obtained, one for the low wind speed case (Figure 18) and one for the high wind speed case (Figure 19). The model velocity profiles reproduce a power-law behavior with exponents of 0.75 and 0.72 respectively. The Bulk Richardson number for the low wind speed case was 3.21 and for the high wind speed case was 0.73.

5.2 VISUALIZATION

Visualization test results consist of photographs, sketches (Figures 20, 21, 22), and movie sequences showing the general nature of airflow and diffusion in the vicinity of the LNG tank and dike complex. A general understanding of wake and cavity flows is helpful for an interpretation of the plume behavior.[41] Complete sets of movie and still photographs supplement this report. Color motion pictures have been arranged into titled sequences, and the sets available are summarized in Table 4.

Flow visualization indicates that the initial movement of both the plume simulated by a Freon 12-N_2 gas mixture at 70^{o}F and the plume simulated by a He-N_2 gas mixture at -260^{o}F displayed a bouyancy dominated character. The plume fell rapidly down over the dike walls to the ground and then proceeded slowly downwind in an undulating wavelike motion until the atmospheric turbulence started to penetrate this seemingly layered flow and thus give way to increased vertical dispersion with distance downwind.

For the Freon 12-N_2 simulation gas this layering effect was strongly dependent upon the stability, boil off rate, and distance downwind. With neutral stratification the largest boiloff rates simulated (3960 and 2400 lbm/sec for the High Dike and 2534 lbm/sec for the Low Dike) gave this layered appearance for upwards to a prototype equivalent distance of 1500 feet downwind. Figures 20, 21 & 22 give an artist representation of this type of plume geometry for the High Dike, Low Dike at 0^{o}, and Low Dike at 45^{o} respectively. For the lower boiloff rates this layered appearance was broken up by within 200 feet of the plume's leading edge. With stable stratification similar observations were made but instead of the layered appearance giving way to vertical plume growth, the layered appearance dissipated into a wispy, illdefined upper plume boundary that did not grow significantly with height as it moved downwind.

For the He-N_2 simulation gas the observation of this layering effect was most strongly dependent upon stability. With neutral stratification the plume was entrained heavily into the building wake, thus diluting the plume enough so as to make a visual observation of layering difficult. But for the lower wind speeds it was observed that a faint layered appearance did exist out to an equivalent distance of 1500 feet. With stable stratification the layering effect was seen to persist at very large distances downwind and its existence was not markedly effected by the boiloff rate. For the large boiloff rates this layered appearance existed for the entire length of the MWT test section, an equivalent distance of 6600 feet from the release point. For the smaller boiloff rates this layered region existed as far downwind as the plume was visible.

The initial lateral spread and upwind travel of the plume varied markedly with dike geometry, boiloff rate, wind speed, stratification, and simulation gas. The initial lateral spread of the plume was a very well defined curve for the Freon-N_2 simulation gas as it was tagged with titanium oxide which produces a very dense smoke. Unfortunately this same technique could not be applied to the He-N_2 simulation gas so all visualization was dependent on frozen water particles within the cold plume. This method of plume visualization did not allow one to define the actual border of the plume; it only gave a representation of where the main bulk of the plume was located. Due to this the remainder of the discussion on plume boundaries will be limited to only the Freon 12-N_2 simulation gas.

For the same dike geometry the rate of initial plume spread in the lateral directions varied directly with boiloff rate and inversely with wind speed. That is, to maintain approximately the same rate of spread with an increased boiloff, the wind speed would have to be increased and vice versa. At low wind speeds and high boiloff rates the gravity spread rate increases to a point where the plume would spread out to the walls of the tunnel and then crawl upwind of the dike complex in a front perpendicular with the wind direction. With stable stratification the plume would spread out on the ground and migrate quite far upwind (1000 feet) for the higher boiloff rates and low wind speeds. This upwind movement was present to some extent for the lower boiloffs and higher wind speeds. The effect of the different dike geometries is presented in Figures 20, 21, and 22.

The observed effects of the wake and cavity regions generated by the aerodynamics of the tank and dike structure varied with tank and dike geometry, wind speed, and stratification. For the Low Dike and Tank complex the effect of increased plume dispersion due to turbulence in its wake was insignificant. The only aerodynamic effect noticeable for this structure was that of a standing plume in the cavity regions of the tank and dike. For the High Dike and Tank the effect of increased plume dispersion due to turbulence in its wake was most significant. Strong vortices which formed near the ground on each side of dike structure would entrain a large amount of the plume and transport it downwind. This effect would give the plume a bifurcated form on the ground with what appears to be maximum concentrations travelling downwind at a separation distance slightly greater than that of the dike diameter. Another vortex was generated on the tank top and travelled slightly upward in the downwind direction. This vortex appeared to act as a vent to the standing plume in the cavity region. A similar aerodynamic structure as this has been reported for flow over a hemisphere.[42] The strength of these vorticies was enhanced by an increase in wind speed but seemed to disappear almost completely in a stable atmosphere.

5.3 CONCENTRATION MEASUREMENTS

Turbulent diffusion of a simulated LNG plume for two different LNG tank and dike complexes was studied. Concentration measurements were obtained for as many as 50 different sample points distributed over a ground level zone of 300 to 6600 feet by 800 feet wide and in the vertical over a height of 0 to 400 feet. A representative layout of this array is shown in Figure 5. One is referred to Table 10 for the specific location of each sampling point for the different tests performed. All concentration data has been placed into the dimensionless forms of $\frac{\chi \bar{u} H^2}{Q}$ and χ x 100, where χ is the normalized concentration observed at the sample point, Q is the boiloff rate, $\bar{u}$ is the mean wind speed averaged over the height H. An explanation of how these values are obtained and how to use them is given in Section 3.5.1. The ranges of the various scaling parameters and test conditions are summarized in Tables 1 and 2 for prototype and model respectively. For the specific test conditions for each test performed one is referred to Table 10.

The concentration results for two different dike configurations subject to various simulation gases, boiloff rates, wind speeds, wind direction, stratification, and model scales are presented in Table 10. The coordinates x, y, and z shown in the tables are explained in the definition sketch in Figure 5. If an asterisk is next to the x coordinate this indicates that these values were obtained at a different time than the non-asterisk coordinates. Ground level contour plots of percent methane over the part of the test section equipped with concentration sampling points are presented in Figures 23-1 to 23-17. These contour plots are a result of linearly interpolating between points generated as a result of a cubic spline fit of crosswind data followed by a cubic spline fit of the variation of the ln(χx100) vs. ln downwind distance. A series of vertical concentration profiles at different distances downwind is presented in Figures 24-1 to 24-12 for the different selected test conditions as indicated in Table 8. A complete set of graphs indicating the maximum dimensionless concentration coefficient at the different nondimensional downwind distances is presented in Figures 25-1 to 25-17. The Locator Table 9 may be used to guide the reader to a certain set of test conditions.

6.0 DISCUSSION OF TEST RESULTS

In order to obtain a comparable characteristic curve among the set of different tests, the test conditions were grouped on the basis of release gas flow rates, wind speeds, stability and simulation gas. Although different release rates and wind speeds normally collapse on to a single curve if the data is presented in the form $K = \frac{\chi \bar{u} H^2}{Q}$ vs $\frac{x}{H}$ for this study such universiality was not the case.

At least two mechanisms can be identified which tend to prevent the classical correlation of concentration decay over the complete range of boiloff rates and wind velocities examined. In the immediate vicinity of the tank and dike plume spread is dominated by buoyancy forces. Thus a buoyancy length scale such as

$$\ell_b = \frac{g(\rho_g - \rho_a)Q}{\pi \rho_a \bar{u}^3}$$

may be more appropriate than H to scale dispersion in this region. A plot of

$$K_{\ell_b} = \frac{\chi \bar{u} \ell_b^2}{Q} \quad \text{vs} \quad \frac{x}{\ell_b} \quad \text{for} \quad \frac{x}{H} < 10.0$$ collapses concentration data from the twelve sets of neutral Freon-N_2 High Dike releases all on to a single line (Figure 26). Yet in Figures 25 the classical correlation

permits an order of magnitude variation in K at a given x/H. The buoyancy length scale parameter correlates data over two model scales, four wind speeds, and six boiloff rates within a factor of two.

As the effluent moves downwind one may expect aerodynamic surface turbulence to dominate the dispersion process. Most data do collapse on K vs x/H curves for $x/H > 10$; however there appears to be two natural groupings of such data. When boiloff rate is large or wind speed is small the dense plume spreads laterally until it is constrained by the wind tunnel walls. Subsequently the plume is channeled downwind without additional lateral spread. Since the frontal like movement of the lateral plume boundary is an important contribution to entrainment of ambient air plume dilution decreases. Indeed, after such blockage, the plume disperses more like a line source and $K \sim (x/H)^{-1}$.

For the purposes of discussion and clarity data from different tests with the same basic characteristics have been plotted together on individual graphs. In the following paragraphs these graphs of dimensionless concentration coefficient, K, vs non-dimensional downwind distance, x/H, will be interpreted.

Freon - 12-N_2 Release, High Dike, Neutral Stratification

High boiloff rate tests (2400-3960 lbm/sec) are gathered together on Figure 25-1. As expected from visualization there is evidence of plume blockage by the wind tunnel side walls; thus maintaining high values of K at large x/H.

Run 101 which was a high boiloff situation (3960 lbm/sec) but at 1/500 scale is plotted in Figure 25-2. As a result of the smaller model the plume behaves more like a typical plume in the wake of a building. An initial -0.67 slope (Yang and Meroney,[29] Hoot et.al.[36]) is followed by a tail off to ~ -1.7 slope (Category C or D Pasquill-Gifford). This behavior agrees with field experience sited by AGA Report IS-31 (1974)[1] as transposed into Figure 1. The initial -0.67 slope is considered to be a joint result of aerodynamic mixing behind the tank and the buoyancy influence of the dense plume.

All other tests in this class behave similar to Run 101. K appears to correlate most of the influence of variation of $\bar{u}$ and Q at large x/H. As boiloff decreases the concentration coefficient K at a given x appears to decrease slightly.

Gifford proposed that the wake diluting effects of building turbulence may be accounted for by the simple approximation

$$K = \frac{H^2}{\sigma_y \sigma_z + CA} \sim \frac{H^2}{CA}$$

where C ranges from 0.5 to 2.0.[29] Concentrations measured in the region x/H ~ 3 were from two to four times greater than this parameter would suggest.

The aerodynamic effects that were observed in the visualization tests were also present to some extent in the concentration results. The ground contour plots of the high dike with a simulation gas of Freon 12-N_2 as presented in Figures 23-2 and 23-3 show the effect of a bifurcated plume. The effect of increased dispersion with wind speed is also readily noticeable by comparing the distances to the LFL for different wind speeds as presented in Tables 6 and 7 and by inspecting the vertical concentration profiles, Figures 24-B and 24-C. By inspection of Tables 6 and 7 it appears that the High Dike would give near the same distance to the LFL as the Low Dike for the same boiloff rates. The information in these tables is inadequate to determine if this definitely is true due to the differences in boiloff rates tested for the Low and High Dikes. The visualization results would indicate that the High Dike should disperse the plume more rapidly.

Freon - 12 - N_2 Release, High Dike, Stable Stratified

Almost all releases of the Freon - 12 - N_2 mixture under stable conditions exhibit a plume maximum above the ground level. Vertical concentration profiles, Figures 24-3 and 4, suggest that the plume initially falls to the ground, elevates slightly, and then diffuses downward again as the plume moves downwind. The simulation gas was adjusted to a specific gravity of 1.4 at a release temperature of 70°F. The simulated ground based inversion, however, has a surface temperature of 32°F. Thus after an initial dilution to a 25 percent mixture with the warm air above the ground based inversion, the specific gravity of the plume on the ground would be near 1.0. If any further mixing of the plume with the warmer air above the floor were to occur the plumes center would rise off the floor. This would cause the ground level concentrations to be high where the plume's momentum takes it to the ground but when the buoyancy forces begin to dominate the plume lifts to an equilibrium level slightly above the ground, thus the sharp decrease in ground level concentration. Further downwind the plume once again falls to the ground due to the fact that in this second stage of development the majority of the air entrained by the plume is at the colder ground temperature of the inversion. The characteristic slanted-S signature to the K vs x/H curves in Figures 25-3 and 4 would confirm the suggested scenario.

Since there is an increased mixing of the elevated plume with increasing wind speed the concentrations measured in the near field ($x/H \sim 3\text{-}10$) are greater for milder stable stratification conditions. As a result of the lofting plume characteristic the plume spreads laterally in a layer moving downwind with a higher average velocity; thus there is no evidence of plume constraint by the wind tunnel walls.

Freon - 12 - N_2 Release, Low Dike Neutral Stratification

Runs 10, 11, 15, 16, and 216 are all high boiloff rate released at low to medium wind velocity, as seen before on Figure 25-1 this data on Figures 25-5 and 6 also display the effects of blockage. Runs 110 and 115 for the 1/666 scale model display concentration decay with distance for a high boiloff flow not influenced by side wall blockage.

As the velocity increases or boiloff rate decreases the plumes decay in a manner similar to neutrally buoyant releases into building wakes. For the higher boiloff conditions concentrations for $x/H < 10$ are greater than Gifford suggests (i.e., $K \sim \frac{1}{C}$); nevertheless for low boiloff rates or higher velocities agreement is good. As the plume spreads and mixes the unblocked plumes asymptotically approach values slightly larger than a comparable C - Pasquill Gifford Category. Hoot, et al.,[36] determined that simple point source releases of dense gas only increase maximum ground concentrations slightly (see Figures 21 and 22, Reference 36). Figure 25-2 and Figure 25-7 when compared suggest that for equivalent boiloff rates and mean velocity conditions the lower dike results in lower concentrations. This is reasonable since the low dike initially spreads a release over a greater surface area. (The advantage of a high dike is in reduced boiloff rates, not in the ability to dilute or spread the effluent.)

Freon - 12 - N_2 Release, Low Dike, Stable Stratification

In Figures 25-8 and 9 we again observe evidence of elevated concentration maximums. Higher velocities with the resultant reduction in stability result in earlier downward dispersion and larger ground concentrations.

He - N_2 Release, High Dike Neutral Stratified

All low wind speed cases exhibit the effects of blockage (see Figure 25-A). At higher wind speeds plumes seem to follow Pasquill - Gifford C or D behavior (Figure 25-B). Run 2 (Freon - 12 - N_2) and Runs 2C and 3C (He - N_2) are quantitatively close in behavior. Comparables Run 302 (Freon - 12 - N_2) and Run 302C (He-N_2) are also similar. Runs 303 and 304 (Freon - 12 - N_2) have the same slope as Runs 303C and 304C (Helium - N_2) although perhaps for the reasons discussed at the end of this section Runs 303C and 304C are shifted to the right on Figure 25-B.

He - N_2 Release, High Dike, Stable Stratification

Blockage conditions appear to exist for data collected on Figure 25-C. The effect is slightly reduced for Runs 23C and 323C plotted on Figure 25-D. Visually very strong layering was observed for most stable He - N_2 releases. Most runs assymptotically approach a K decay behavior of Class F - Pasquill - Gifford.

The elevated plume behavior of the Freon - 12 - N_2 mixture under stable stratification conditions make it inappropriate to directly compare them with the He - N_2 mixture release conditions.

Maximum ground level concentrations for all downwind distances were found under conditions of stable stratification. The reduced ambient turbulence permits the plume to move greater distances downwind without large dilution. Hence the distance to LFL will be greatest under such situations.

He - N_2 Release, Low Dike, Neutral Stratification

Figures 25-E or F do not display any of the characteristics of plume blockage on plume centerline. Nonetheless, Figure 23-14 suggests plume reflection from the wind tunnel side walls does occur but has not yet influenced centerline maximum values. Generally, concentrations decay at rates similar to Class C or D Pasquill - Gifford, but they have higher values for a given x/H as predicted by Hoot, et al.[36]

Runs 16, 17, and 18 (Freon - 12 - N_2) are quantitatively similar in behavior to Runs 16C, 17C, and 18C (He - N_2), although the magnitudes of the latter two cases are slightly larger for He - N_2 release. Magnitudes of K at equivalent x/H for Runs 316C, 317C, and 318C are definitely larger than the comparable Runs 316, 317, and 318.

He-N_2 Release, Low Dike, Stable Stratification

Again it is not possible to compare results for the He - N_2 release with Freon - 12 - N_2 release since plume lofting did not occur in both situations. Indeed it is expected that conditions considered in Figures 25-G and H are more appropriate for comparison to prototype conditions. Visual observations indicated the plume fell to the ground on release, spread across the tunnel, and remained below z/H ~ 0.1 as it travelled downwind. Thus the plumes were all strongly influenced by side wall reflection and low vertical dispersion rates.

Runs 36C, 37C, and 38C correlate well as K vs x/H. Releases at higher average wind speed conditions, Runs 336C, 337C, and 338C are also well grouped. It would appear higher velocities may restrict the plume to a narrower initial shape at release--thus increasing ground level concentration values. Indeed visualization shows plume spreads at an included angle of ~ 120° at low speed conditions but at ~ 90° for higher wind velocities.

Lower Flamability Limit

The approximate distances to the lower flamability limit (LFL) under a variety of different conditions for Freon 12 - N_2 gas simulation and He - N_2 gas simulation are noted in Tables 6 and 7 respectively. It is readily noticeable that with the same test conditions the He - N_2 simulation gas yields the longest distances to the LFL. These differences may be exaggerated somewhat due to the increased severity of wind tunnel side wall reflection for the He - N_2 tests as notes in Section 5.2. By examining the appropriate dimensionless concentration coefficient graphs (Figure 25-1 to 25-9 as compared to 25-A to 25-H) one arrives at the same conclusion, that is a simulation gas of a He - N_2 mixture at -260^{o}F indicates the worst case. These results generally coincide with what was considered in the visualization test series to be the cohesiveness of a layered formation. By comparing the comments made in section 5.0.2 (Visualization Test Results) about the extent of the layered formation between neutral and stable stratifications for the He - N_2 simulation gas with that of the corresponding vertical concentration profiles (24-E as compared to 24-G and 24-F as compared to 24-H) this conclusion about the occurrence of high concentrations is reinforced.

The worse case dispersion condition may result from the damping influence of stable stratification on turbulent transport. In such situations gradient transport theory in inadequate to describe the mixing process. Initially turbulent flux of concentration $\overline{w'\rho'}$ normally increases with density gradient, $-\partial\rho/\partial z$ (or Ri_g); however, as a result of the dampening effects of stratification, $\overline{w'\rho'}$ reaches a maximum and is believed to decrease to zero at larger density gradients. Thus if two portions of a $\rho(z)$ profile lie on different sides of the $\overline{w'\rho'}$ maximum there is a tendency for steepening of the concentration profile resulting in layering near the wall.

Although any stably-stratified flow acts to inhibit turbulence, an additional mechanism may inhibit dispersion for the He - N_2 - cooled mixture over that of the Freon 12 - N_2 mixture. Where significant differences exist in the rates of molecular diffusion of species and molecular transport of heat, doubly diffusive convection has been identified in other cases to lead to strong layering.[42] For a methane air mixture the Lewis number (LE - $a/\mathcal{D}$) has values ranging from 1.2 to 1.0 over the temperature range of 200° to 460° Rankine. Based on the linear characteristic equation developed by Turner and for typical measured temperature and concentration conditions the stability number

$$\beta_y = \frac{\beta \Delta T}{\beta \Delta S} = \frac{\text{Rayleigh No.}_T}{\text{Rayleigh No.}_C} \sim 0.785;$$

thus the measured situation falls within a region where "finger-convection" is thought to occur. Although the phenomenon may explain greater concentrations found during the He - N_2 releases as opposed to the Freon 12 - N_2 releases, until further data is available the presence of the effects must be accepted as only a possibility. Indeed, doubly-diffusive convection is normally significant only in situations where the Lewis No. >> 1.0.

Separation of species due to a temperature gradient (Soret effect) has also been proposed as a mechanism for layering. The ratio of flux due to thermal diffusion to flux due to molecular diffusion is proportional to

$$\frac{(j)_T}{(j)_x} \sim \frac{K_T}{T} \frac{\Delta T}{\Delta x}$$

where K_T is a thermal diffusion ratio, x is mole fraction, and T is absolute temperature. Since $K_T \simeq 0(0.1)$, and the ratio $(j)_T/(j)_x \sim 0(0.04)$ for concentrations and temperatures detected during the laboratory releases the diffusion-thermo effect is felt to be insignificant.

7.0 CONCLUSIONS

This study concerned the rate of dispersion of an initially negatively buoyant methane vapor plume. This plume was considered to be formed as the result of vaporization of a spill of liquified natural gas into a confining dike area. The pertinent meteorological variables of source and site conditions, wind speed and direction, and atmospheric stability were modeled in a wind tunnel. Concentration and temperature measurements and photographic records were obtained for different meteorological conditions.

The results of this study lead to the following conclusions:

1. A methane plume will yield maximum concentrations on the ground level for its entire lifetime.

2. The rate of dispersion of a methane vapor plume increases strongly with decreasing boiloff rate; increases with increasing wind speed, although the dependence is not as strong as with a neutral plume; decreases with increasing stability; and does not appear in the far wake to be a function of the tank and dike geometry.

3. The classical methods of describing plume dispersion in the wake of a building do not describe the behavior in the near wake very well. The concentration values in the near wake are much higher than Gifford's model suggests and the decay of the concentration coefficient K with distance only asymtotically approaches that of the proper Pasquill Diffusion Category.

4. The shape of the plume spread in the near vicinity of the model was observed. Its prominent features are a very pronounced lateral spread with the possibility of plume growth in the upwind direction, and a strongly bimodal shape in the downwind direction.

5. A reasonable estimate based on physical simulation of the extent of the hazard zone in the event of a catastrophic spill of liquified natural gas under a vairety of different conditions is present in Tables 6 and 7.

Suggestions for future research on the topic of laboratory simulation of a methane vapor plume are:

1. There is a need for verification of Reynolds Number independence in the behavior of a negatively buoyant plume. Due to the severe dampening of the density gradient in the plume the motion may be laminar at some time period in the plume's life.
2. Further experiments to determine if the equality of density ratios for model and prototype may be relaxed so that more convenient laboratory wind speeds may be used.
3. Experiments utilizing a small model or a larger wind tunnel are needed so that the effects of wind tunnel blockage of the plume at higher boiloff rates does not affect results.
4. A time variable boiloff rate and an instantaneous concentration measurement system need to be developed so that the actual physical process is modeled correctly.
5. The general plume behavior from an area source without the complications of building wake turbulence needs to be investigated much more thoroughly to obtain mathematical models that will describe the extent of lateral spreading and downwind diffusion for different wind speeds, boiloff rates, and atmospheric stabilities.

REFERENCES

1. American Gas Association (1974a) "LNG Safety Program, Interim Report on Phase II Work," Report on American Gas Association Project IS-3-1, Battelle Columbus Laboratories.

2. Feldbauer, G. F., et al. (1972) "Spills of LNG on Water-Vaporization and Downwind Drift of Combustible Mixtures," ESSO Report No. EE61E-72, November.

3. Burgess, D. S., Biardi, J., and Murphy, J. N. (1972) "Hazards of Spillage of LNG Into Water," Bureau of Mines, MIPR No. Z-70099-9-12395.

4. American Gas Association (1974b) "Evaluation of LNG Vapor Control Methods," Report by Arthur D. Little, Inc., Cambridge, Mass., Catalog No. M19875/5C3.75-469, October.

5. Van Ulden, A. P. (1974) "On the Spreading of a Heavy Gas Released Near the Ground," Loss Prevention and Safety Promotion Seminar, Delft, Netherlands, 6 pp.

6. Ecosystems, Inc. (1973) "Expected Behavior of an LNG Release Under Specified Conditions," Study for Federal Power Commission, Ecosystems Inc., McLean, Va., August 13. 40 pp.

7. Fay, J. A. (1973) "Unusual Fire Hazard of LNG Tanker Spills," Combustion Science and Technology, Vol. 7, pp. 47-49.

8. Murphy, J. M. (1974) Comments on Draft Environmental Impact Statement, "EASCO Gas LNG, Inc. and DISTRIGAS Corporation," Final Environmental Impact Statement, Vol. 2, For the Conduction and Operation of an LNG Impact Terminal at Staten Island, N.Y., 35 pp.

9. Harsha, P. T. (1976) Private Communication, R & D Associates, Marina del Rey, California.

10. Halitsky, J., Golden, J., Halpern, P., and Wu, P., (1963) "Wind Tunnel Tests of Gas Diffusion from a Leak in the Shell of a Nuclear Power Reactor and from a Nearby Stack," Geophysical Sciences Laboratory Report No. 63-2, New York University, April.

11. Kalinske, A. A. (1945) "Wind Tunnel Studies of Gas Diffusion in a Typical Japanese Urban District," National Defense Res. Council OSCRD Informal Report No. 10, 3A-48 and 48a.

12. Davies, P. O. A. L., and Moore, P. L. (1964) "Experiments on the Behavior of Effluent Emitted from Stacks at or Near the Roof Level of Tall Reactor Buildings," Int. Jour. Air Water Pollution, Vol. 8, pp. 515-533.

REFERENCES (continued)

13. Sherlock, R. H. and Stalker, E. A. (1940) "The Control of Gases in the Wake of Smokestacks," Mechanical Engineering, Vol. 62, No. 6, pp. 455-458, June.

14. Hohenleiten, H. L. von and Wolf, E. (1942) "Wind Tunnel Tests to Establish Stack Heights for the Riverside Generating Station," Trans ASME, Vol. 64, pp. 671-683, October.

15. Martin, J. E. (1965) "The Correlation of Wind Tunnel and Field Measurements of Gas Diffusion Using Kr-85 as a Tracer," Ph.D. Thesis, MMPP 272, University of Michigan, June.

16. Meroney, R. N., Cermak, J. E., Chaudhry, F. H. (1968) "Wind Tunnel Model Study of Shoreham Nuclear Power Station Unit 1, Long Island Lighting Company," Progress Report No. 1, Fluid Dynamics and Diffusion Laboratory Report No. CER68-69RNM-JEC-FHC1, Colorado State University, Fort Collins, Colorado, July.

17. Meroney, R. N., Cermak, J. E., and Chaudhry, F. H. (1968) "Wind Tunnel Model Study of Shoreham Nuclear Power Station Unit 1, Long Island Lighting Company," Progress Report 2, Fluid Dynamics and Diffusion Laboratory Report No. CER68-69RNM-JEC-FHC14, Colorado State University, Fort Collins, Colorado, October.

18. Cermak, J. E. and Nayak, S. K. (1973) "Wind-Tunnel Model Study of Downwash from Stacks on Maui Electric Company Power Plant, Kahului, Hawaii," Fluid Dynamics and Diffusion Laboratory Report No. CER72-73JEC-SKN8, Colorado State University, Fort Collins, Colorado, March.

19. Dickson, C. R., Start, G. E. and Markee, E. H., Jr., (1967) "Aerodynamic Effects of the EBR-II Containment Vessel Complex on Effluent Concentrations," USAEC Meteorological Information Meeting, Chalk River, Canada, AECL-2787, pp. 84-104, September 11-14.

20. Munn, R. E., Cole, A. F. W., Sandborn, V. A., Plate, E. J., Binder, G. J., Chuang, H., Meroney, R. N., and Ito, S (1967) "Turbulence and Diffusion in the Wake of the Building," Atmospheric Environment, Vol. 1, pp. 34-43.

21. Halitsky, J. (1963) "Gas Diffusion Near Buildings," Geophysical Science Laboratory Report No. 63-3, New York University, February.

22. Cermak, J. E. (1975) "Applications of Fluid Mechanics to Wind Engineering, A Freeman Scholar Lecture," J. of Fluids Engineering, Vol. 97, Ser. 1, No. 1, pp. 9-38.

REFERENCES (continued)

23. Cermak, J. E., Sandborn, V. A., Plate, E. J., Binder, G. J., Chuang, H., Meroney, R. N., and Ito, S. (1966) "Simulation of Atmospheric Motion by Wind-Tunnel Flows", Fluid Dynamics and Diffusion Laboratory Report No. CER66-JEC-VAS-EJP-GJB-HC-RNM-SI17, Colorado State University, Fort Collins, Colorado.

24. Schlichting, H. (1960) Boundary Layer Theory, McGraw Hill, New York.

25. Field, J. H. and Warden, R.(1933) "A Survey of the Air Currents in the Bay of Gibraltar, 1929-1930," Air Ministry, Geophys, Mem. No. 59, London.

26. Cermak, J. E. and Peterka, J. (1965) "Simulation of Wind Fields Over Point Arguello, California, by Wind-Tunnel Flow Over a Topographical Model," Final Report, U. S. Navy Contract N 126(61756) 34361 A(PMR), Fluid Dynamics and Diffusion Laboratory Report No. CER65-JEC-JAP64, Colorado State University, Fort Collins, Colorado, December.

27. Meroney, R. N. and Cermak, J. E. (1967) "Wind Tunnel Modeling of Flow and Diffusion Over San Nicolas Island, California," U.S. Navy Contract N123(61756)50192 A(PMR), Fluid Dynamics and Diffusion Laboratory Report No. CER66-67RNM-JEC44, Colorado State University, Fort Collins, Colorado, September.

28. Jensen, M. and Frank, N. (1963) "Model-Scale Test in Turbulent Wind, Part I," The Danish Technical Press, Copenhagen.

29. Yang, B. T. and Meroney, R. N. (1970) "Gaseous Dispersion into Stratified Building Wakes," AEC Report No. COO-2053-3, Fluid Dynamics and Diffusion Laboratory Report No. CER70-71 BTY-RNM8, Colorado State University, Fort Collins, Colorado, August.

30. Cermak, J. E. (1971) "Laboratory Simulation of the Atmospheric Boundary Layer," AIAA Jl., Vol. 9, No. 9, pp. 1746-1754, September.

31. Yamada, T. and Meroney, R. N. (1971) "Numerical and Wind Tunnel Simulation of Response of Stratified Shear Layers to Nonhomogeneous Surface Features," Project THEMIS Tech. Report No. 9, ONR Contract No. N00014-68-A-0493-0001, Fluid Dynamics and Diffusion Laboratory Report No. CER70-71TY-RNM62, Colorado State University, Fort Collins, Colorado.

32. SethuRaman, S. S. and Cermak, J. E. (1973) "Physical Modeling of Flow and Diffusion Over an Urban Heat Island," Proc. Second IUTUM-IUGG Symposium on Turbulent Diffusion in Environmental Pollution, Charlottesville, Virginia, April 8-14.

REFERENCES (continued)

33. Sutton, O. G. (1953) Micrometeorology, McGraw-Hill.

34. Panafsky, H. A., Blockadar, A. K. and McVehil, G. E. (1961) "The Diabatic Wind Profile," Quart. J. R. Meteor. Soc., Vol. 86, pp. 390-398.

35. Hall, D. J., Barrett, C. F., and Ralph, M. O. (1975) "Experiments on a Model of an Escape of Heavy Gas," Warren Spring Laboratory Report CR882(AP), Dept. of Trade and Industry, United Kingdom.

36. Hoot, T. G. and Meroney, R. N. (1974) "The Behavior of Negatively Buoyant Stack Gases," 67th Annual Meeting APCA, June 9-13, 1973, Denver, Colorado, Paper No. 74-210, 21 pp.

37. Bodurtha, F. T., Jr. (1961) "The Behavior of Dense Stack Gases," J. of APCA, Vol. 11, No. 9, pp. 431-437.

38. Boyle, G. J. and Kneebone, A. (1973) "Laboratory Investigation into the Characteristics of LNG Spills on Water, Evaporation, Spreading and Vapor Dispersion," Shell Research, Ltd., Report to API, March.

39. Plate, E. J. and Cermak, J. E. (1963) "Micro-Meteorological Wind-Tunnel Facility: Description and Characteristics," Fluid Dynamics and Diffusion Laboratory Report No. CER63-EJP-JEC9, Colorado State University, Fort Collins, Colorado.

40. Dear, D. J. A. and Robins, A. G. (1974) "A Technique Used to Study the Dispersion of Gases in the MEL 9.14 m x 2.74 m Wind Tunnel," Central Electric Generating Board Report R/M/N752, United Kingdom.

41. Halitsky, J. (1963) "Gas Diffusion Near Buildings," Geophysical Science Laboratory Report No. 63-3, New York University.

42. Turner, J. S. (1973) "Buoyancy Effects in Fluids," Cambridge University Press, Great Britain.

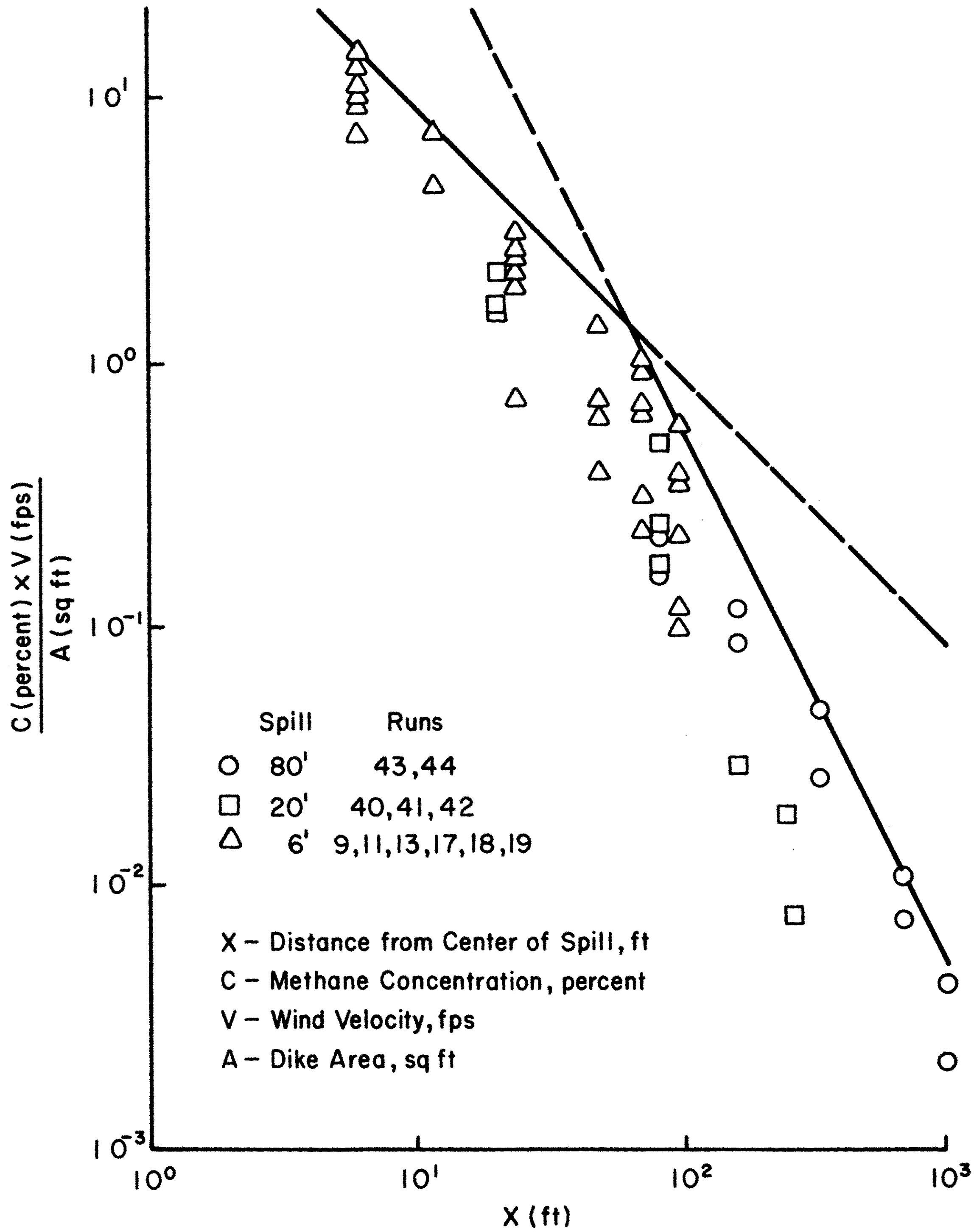
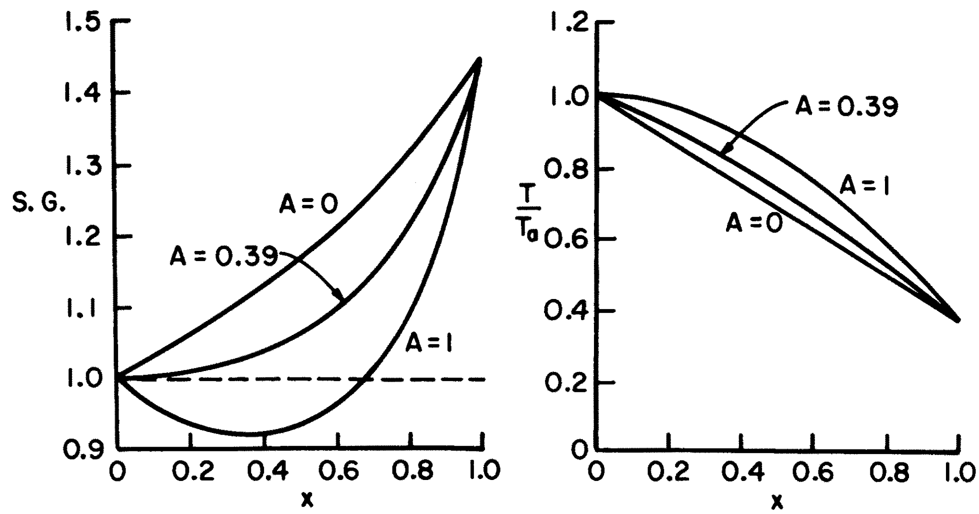
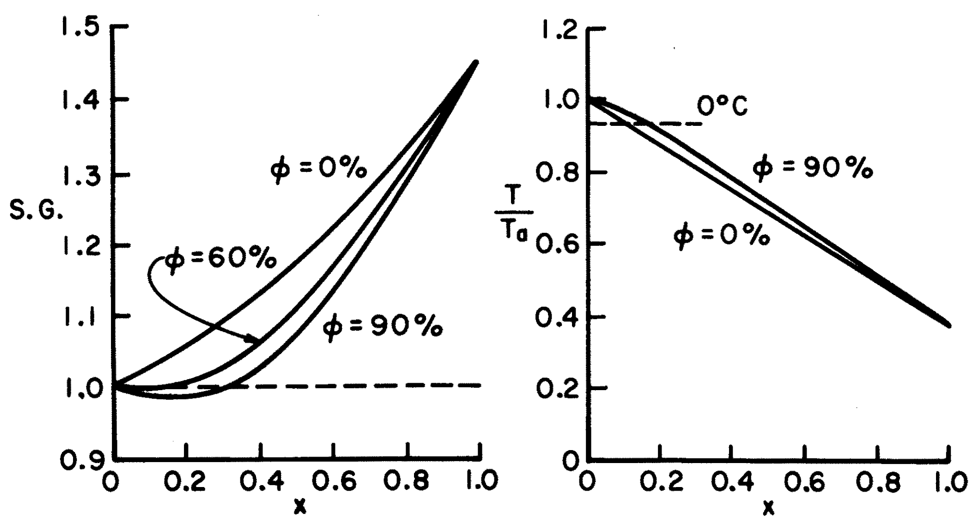


Figure 1. Peak Concentration Correlation with Distance from Spill.[1]



Dry Air Mixture



Moist Air Mixture

Figure 2. Theoretical Behavior of LNG Plumes.

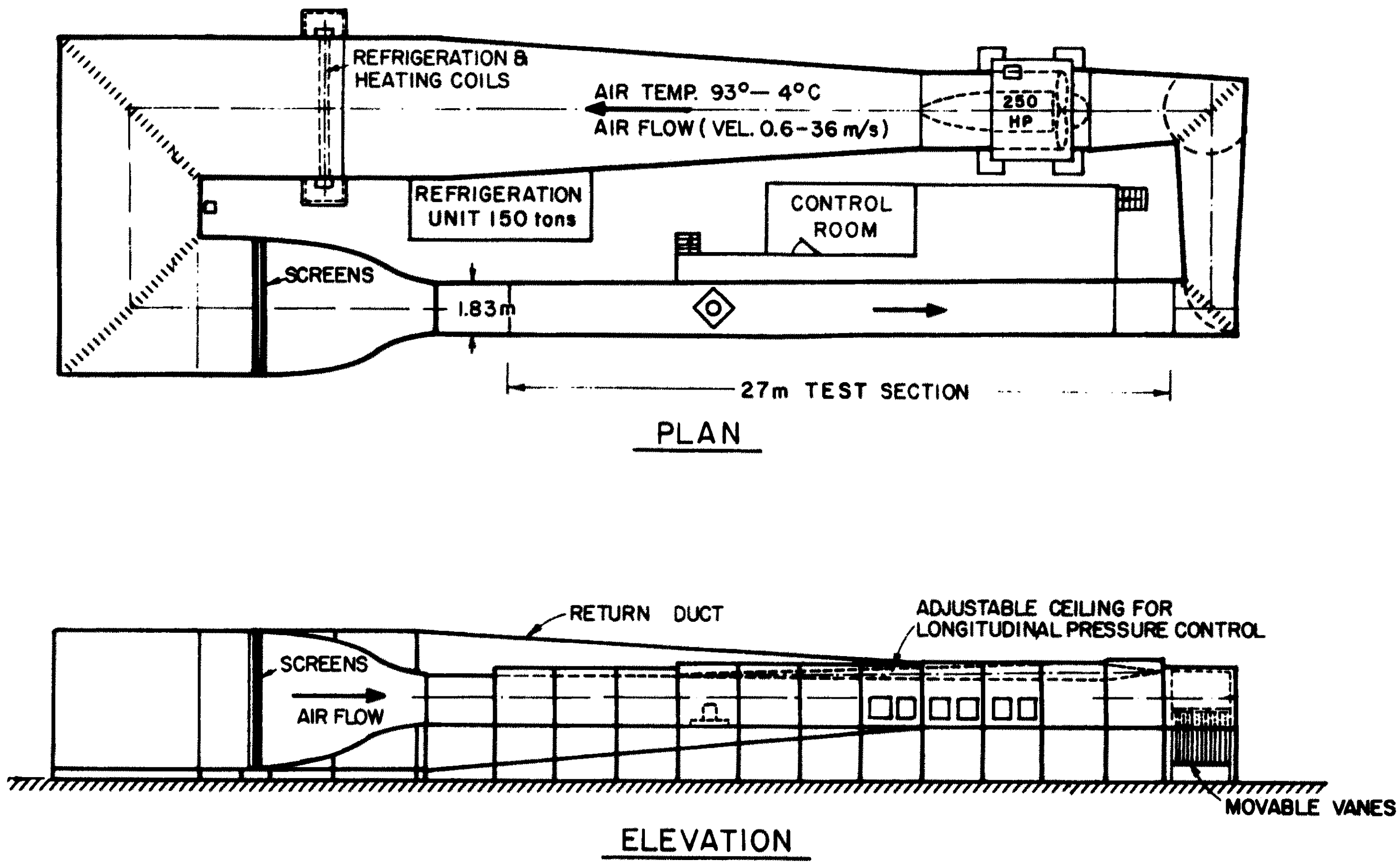


Figure 3. The Meteorological Wind Tunnel.

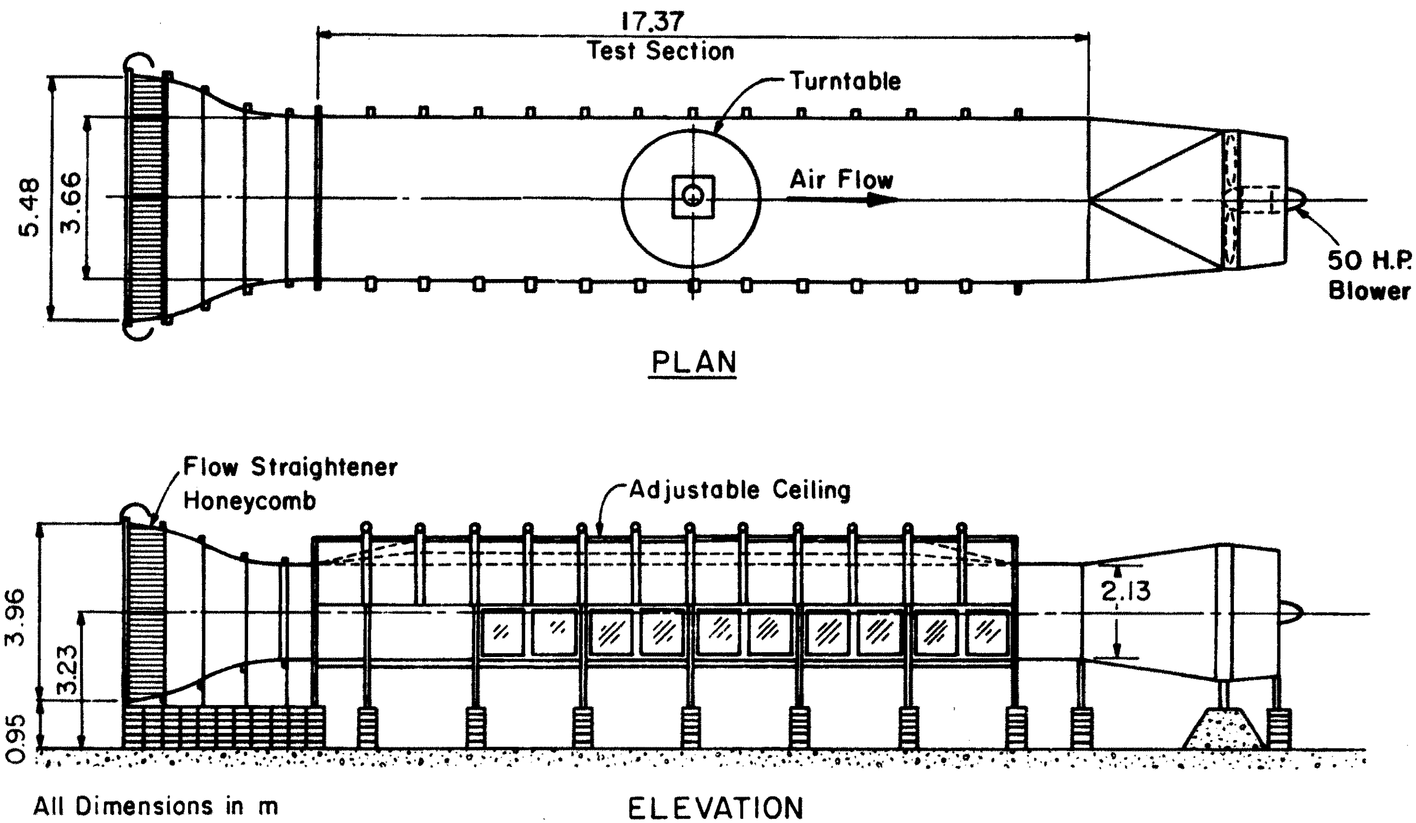


Figure 4. The Environmental Wind Tunnel.

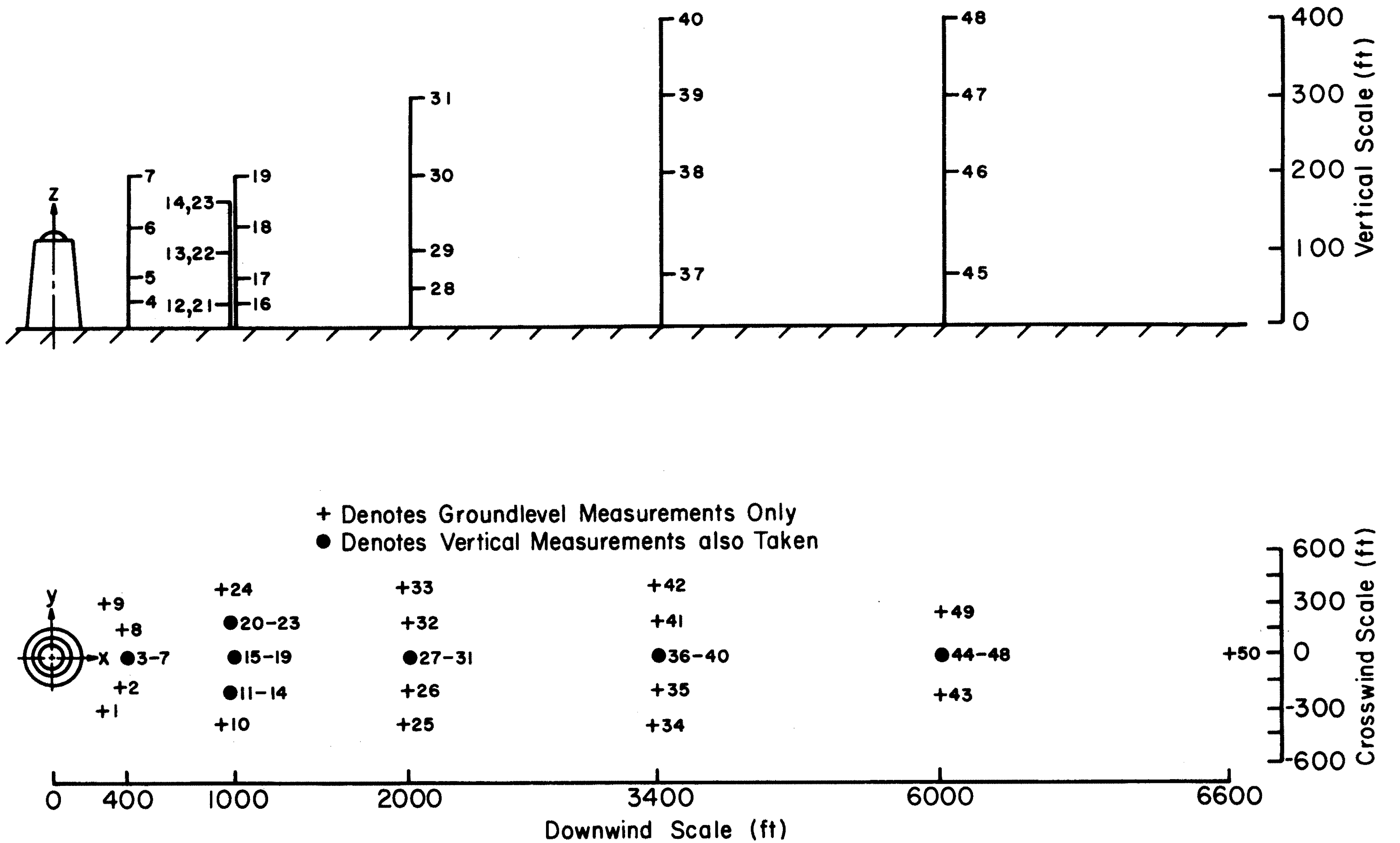


Figure 5. Typical Coordinates for Concentration Measuring Locations

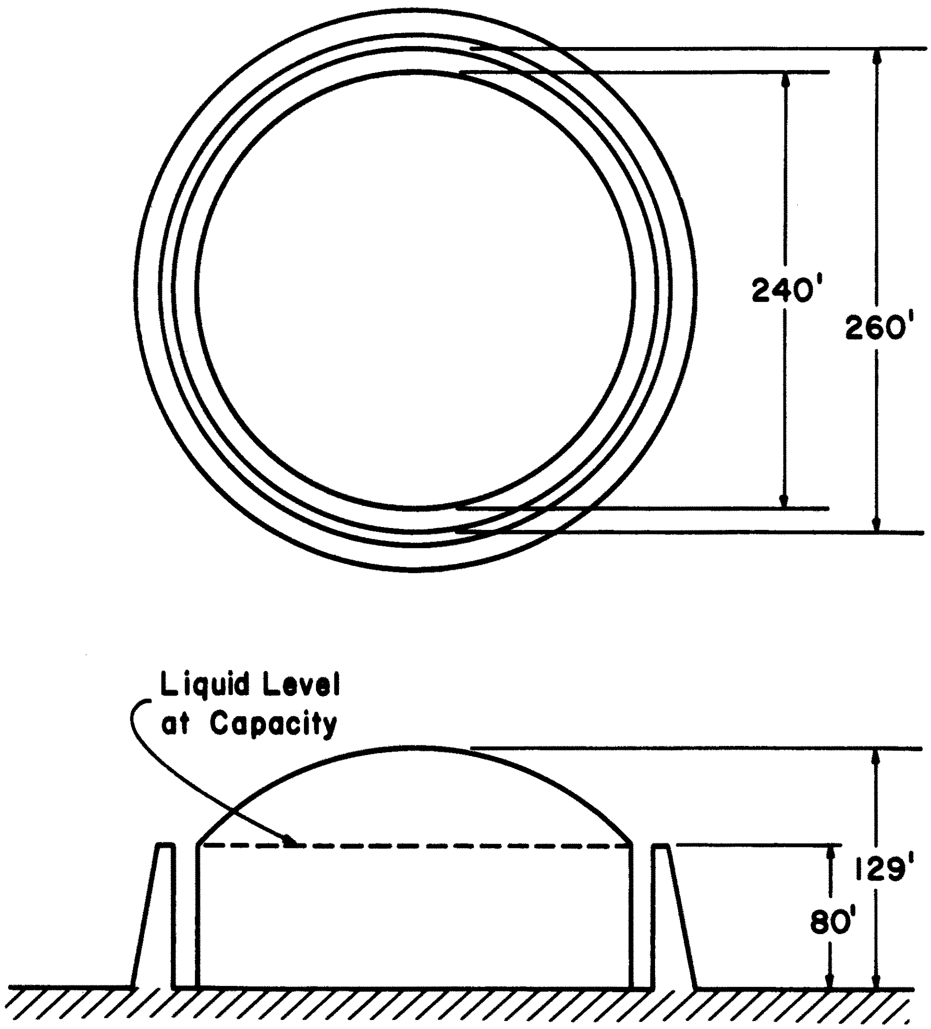


Figure 6. Representative High Dike.

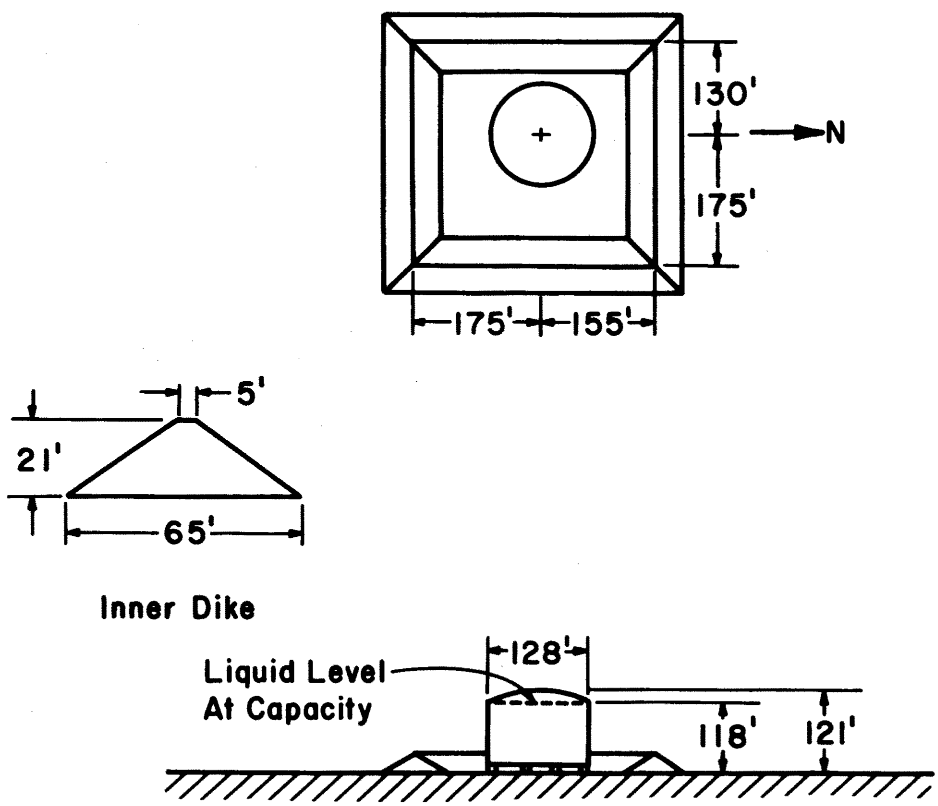


Figure 7. Representative Low Dike.

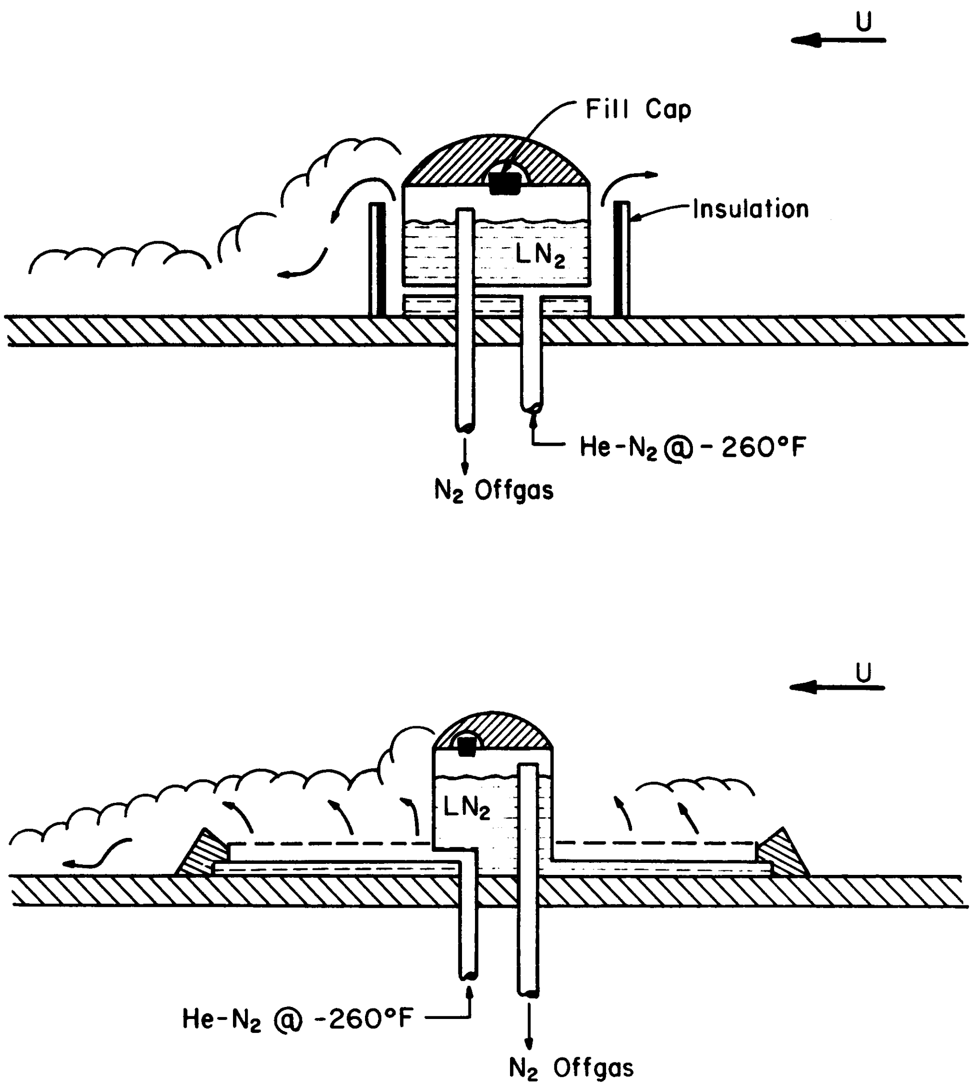


Figure 8. High and Low Dike Models for Simulation with Helium-Nitrogen Gas Mixture.

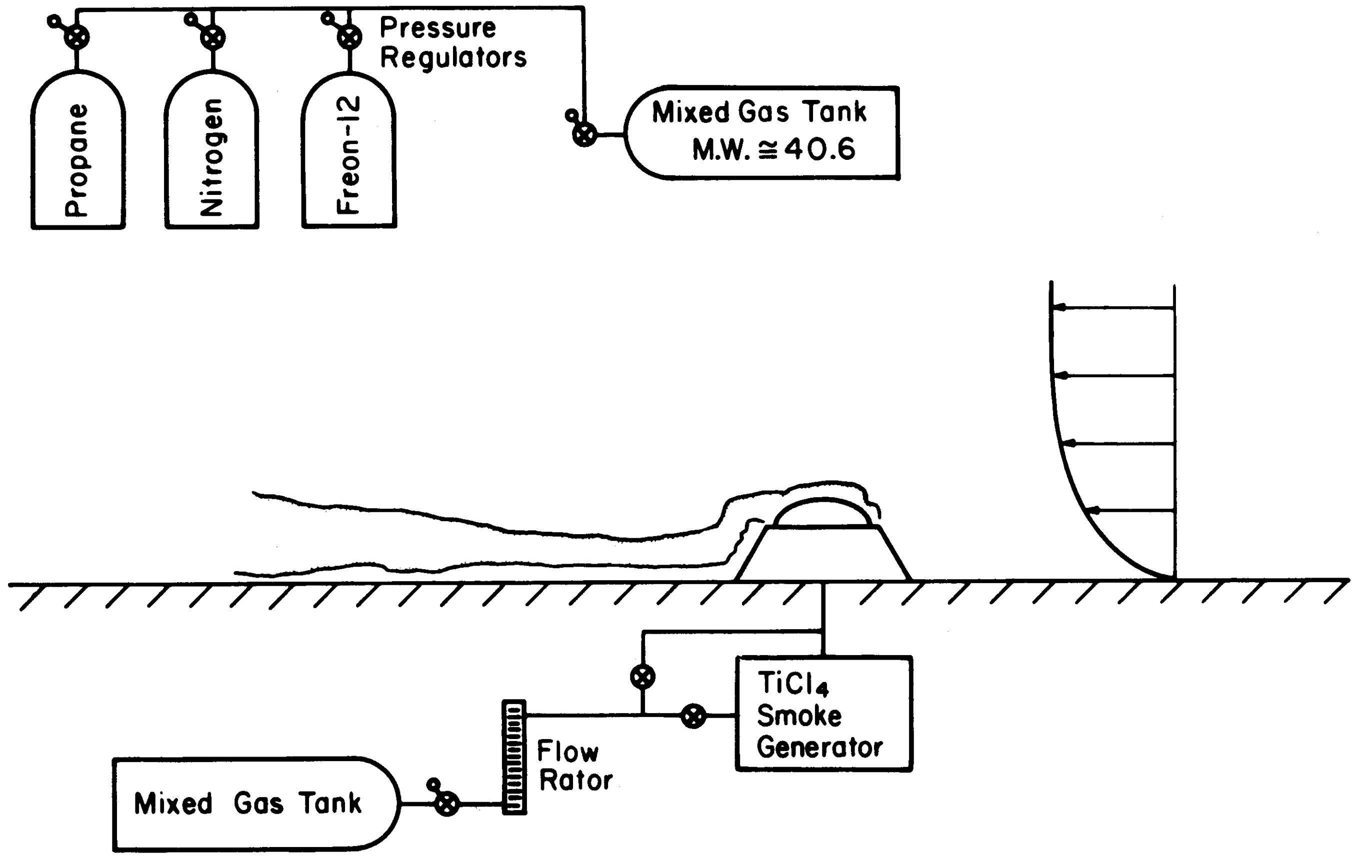


Figure 9. Gas Release System for Simulation with Freon-Nitrogen Gas Mixture.

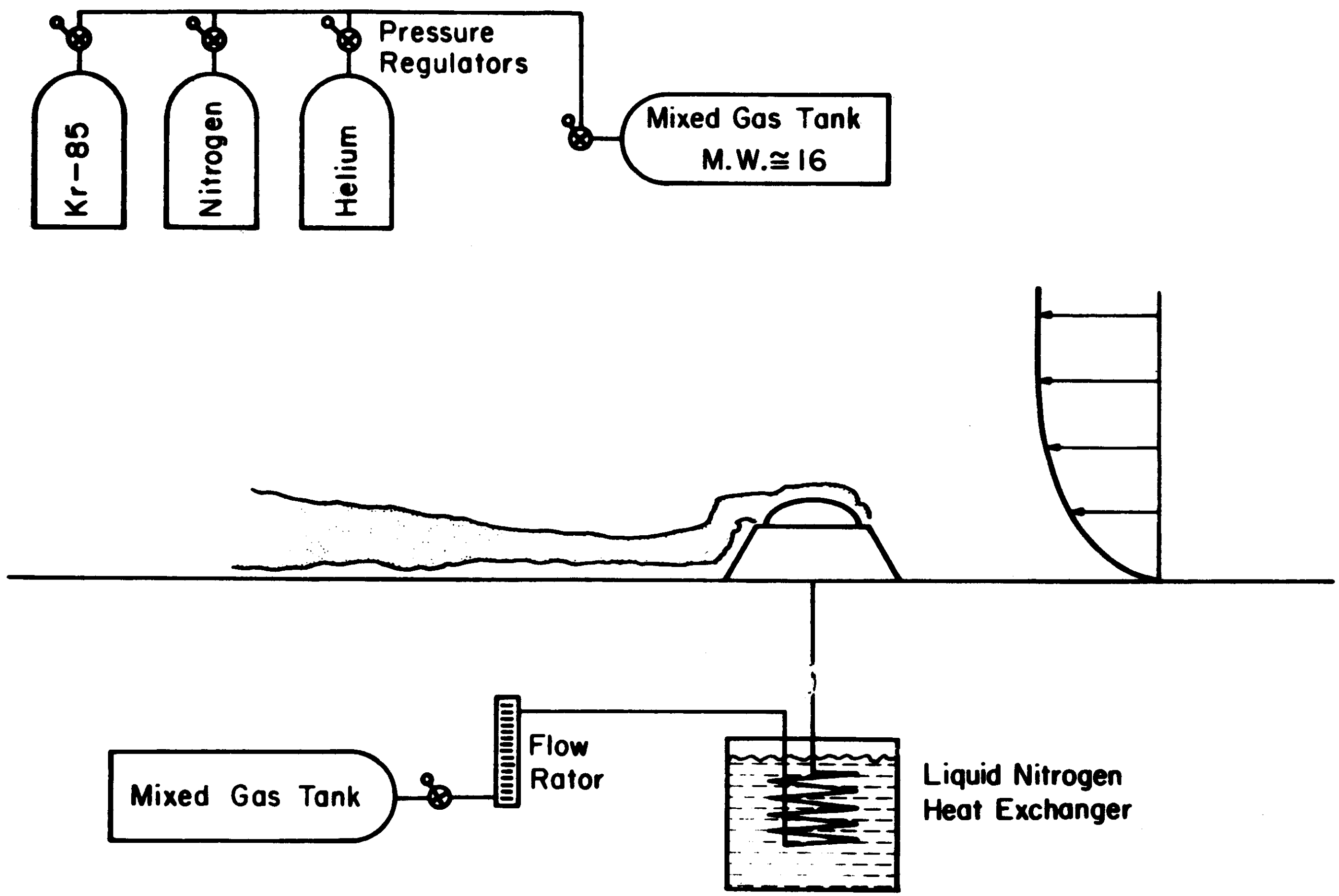


Figure 10. Gas Release System for S`mulation with Helium-Nitrogen Gas Mixture.

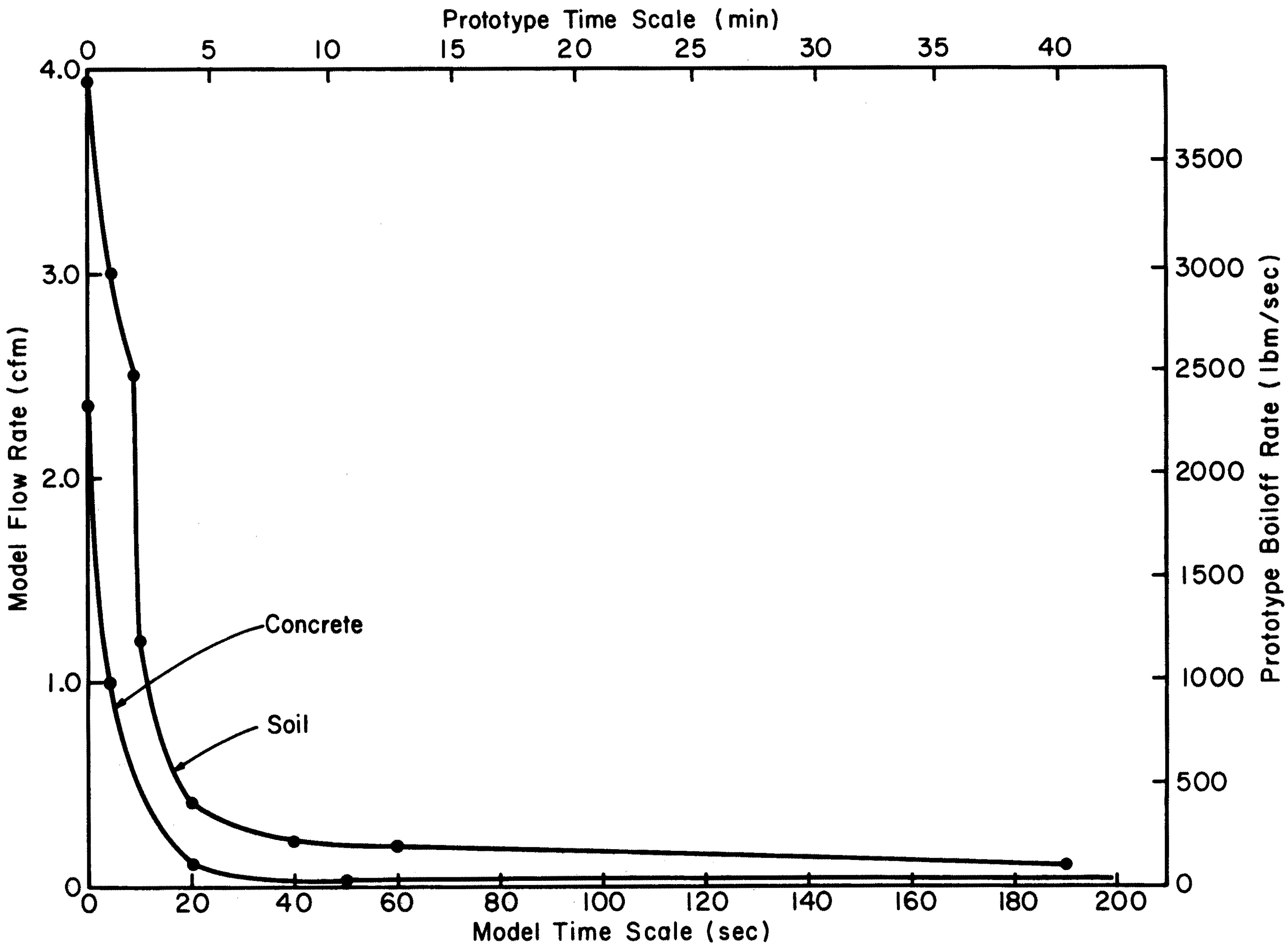


Figure 11. High Dike Gas Release Rates for Model and Prototype.

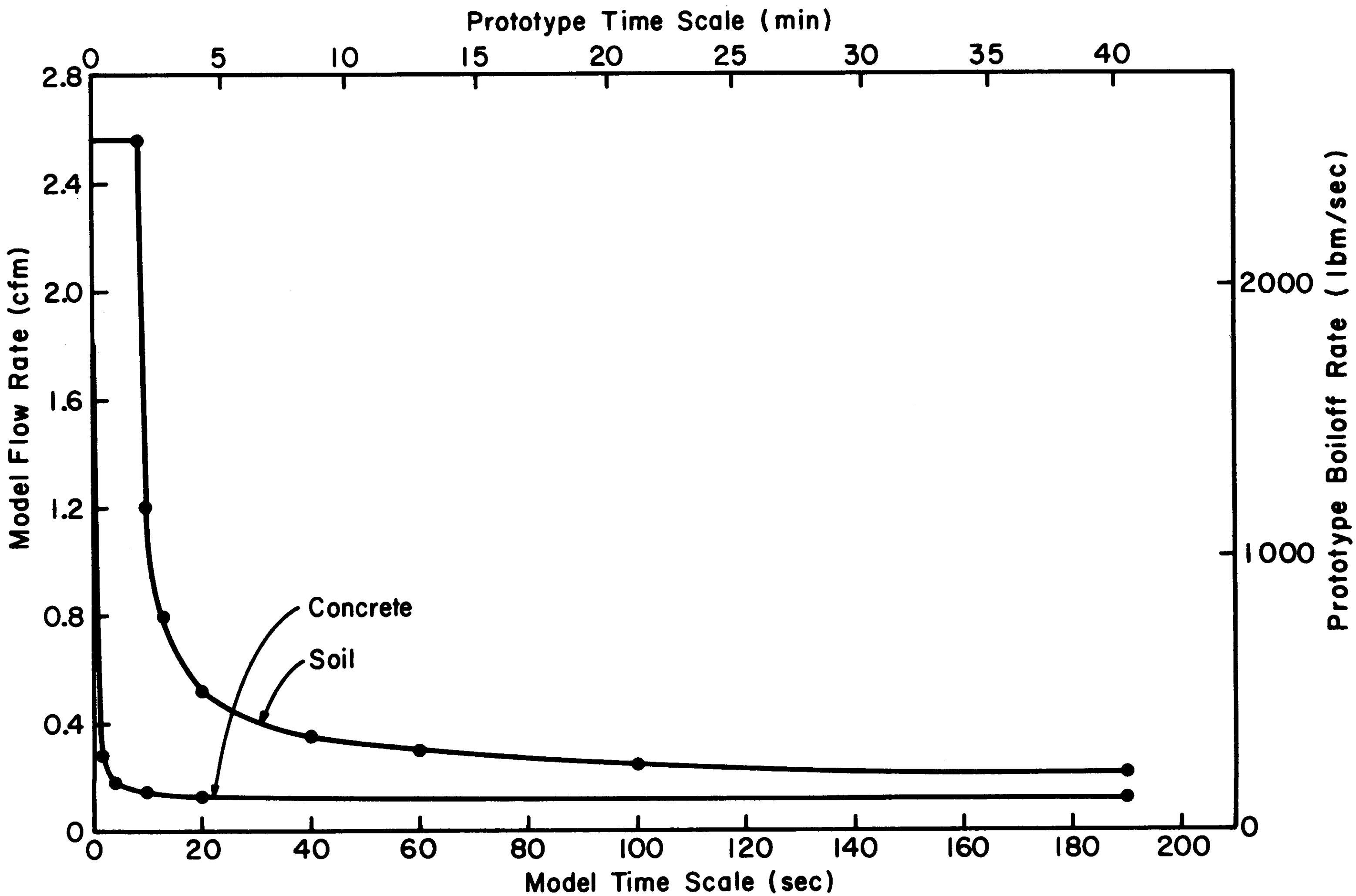


Figure 12. Low Dike Gas Release Rates for Model and Prototype.

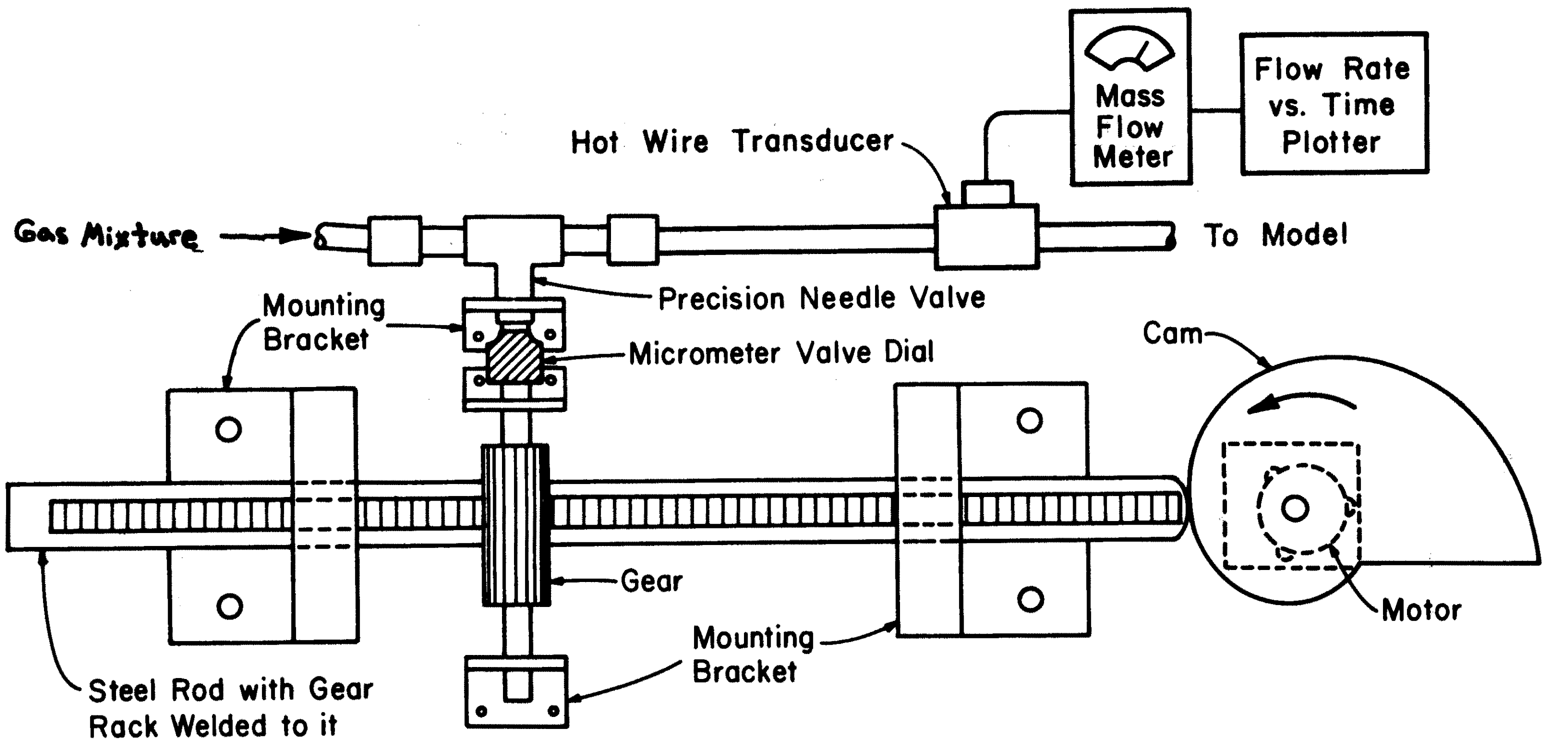


Figure 13. Variable Flow Rate Control Valve.

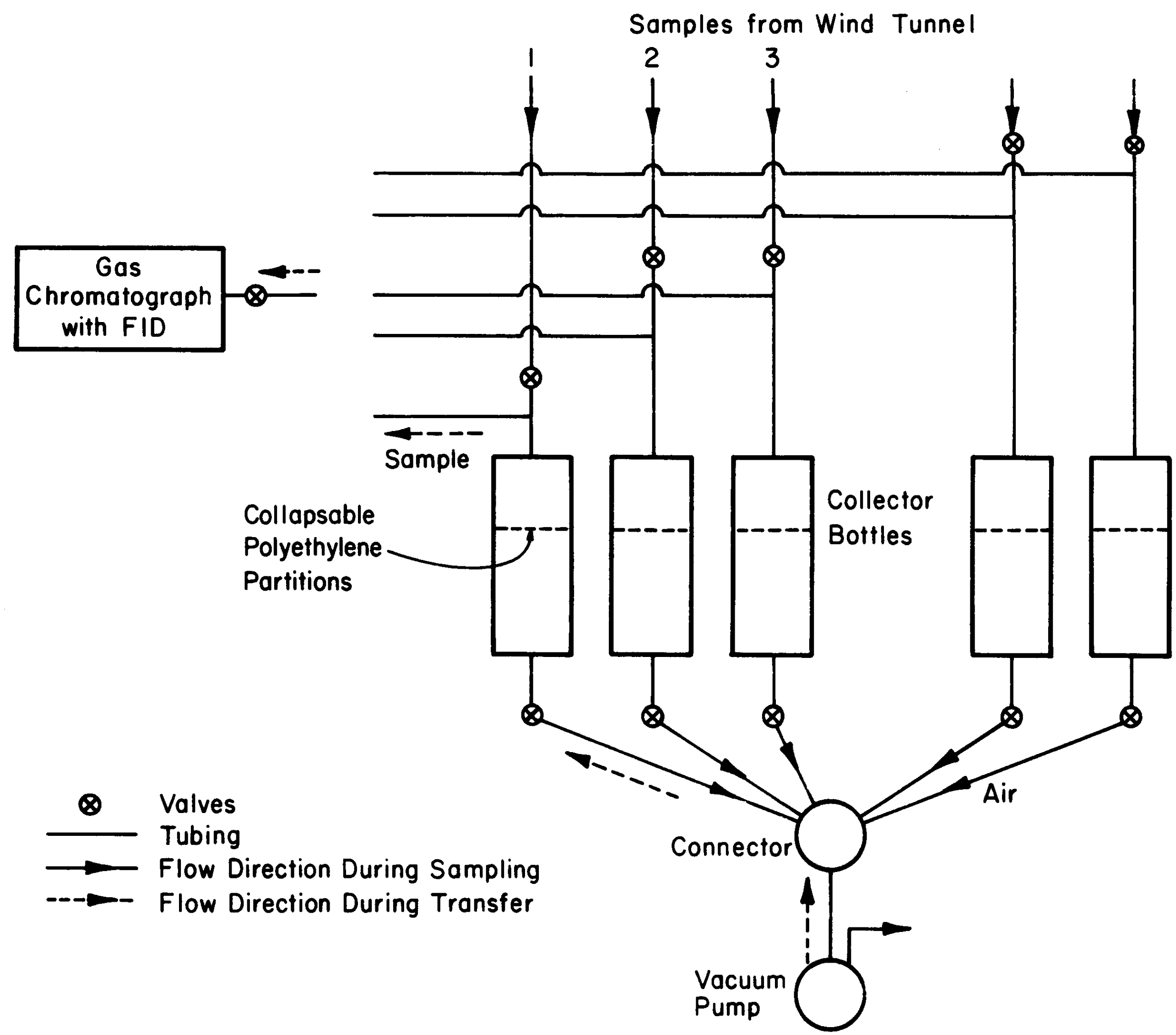


Figure 14. Propane Tracer - Gas Sampling and Analysis System - Schematic.

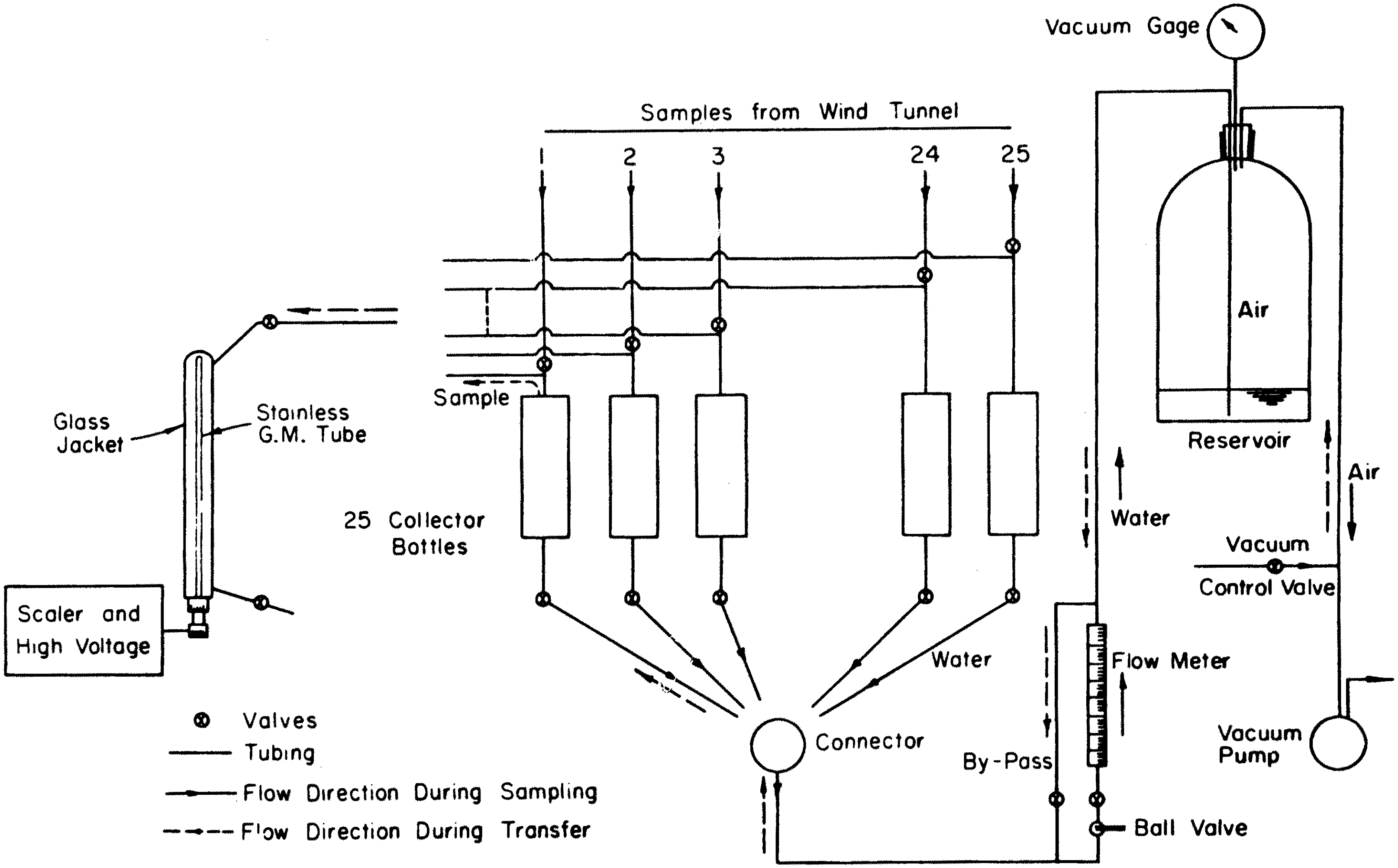


Figure 15. Kr-85 Tracer - Gas Sampling and Analysis System - Schematic.

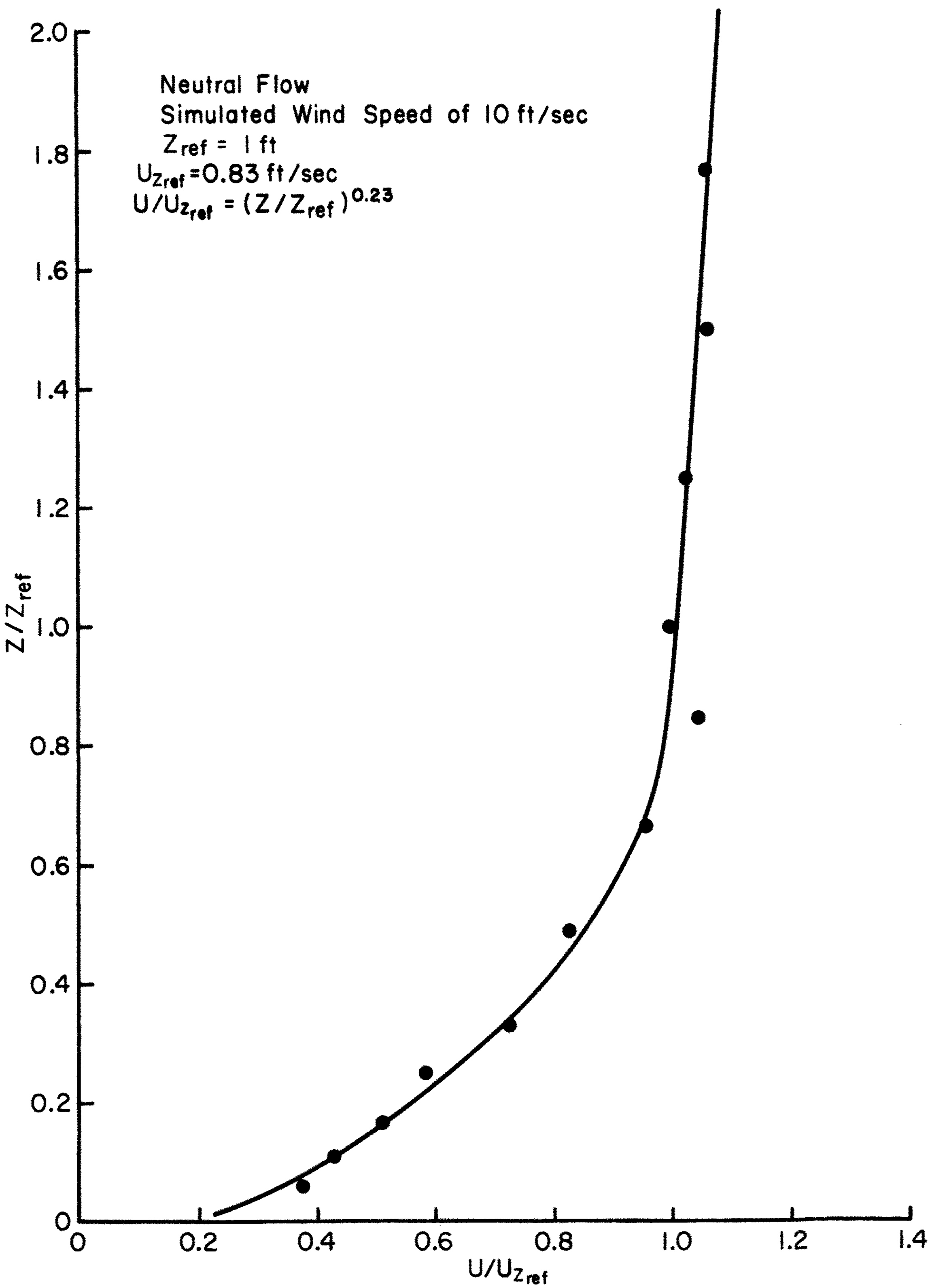


Figure 16 Velocity Profile, Neutral Flow at Lower of Wind Speeds. Meteorological Wind Tunnel

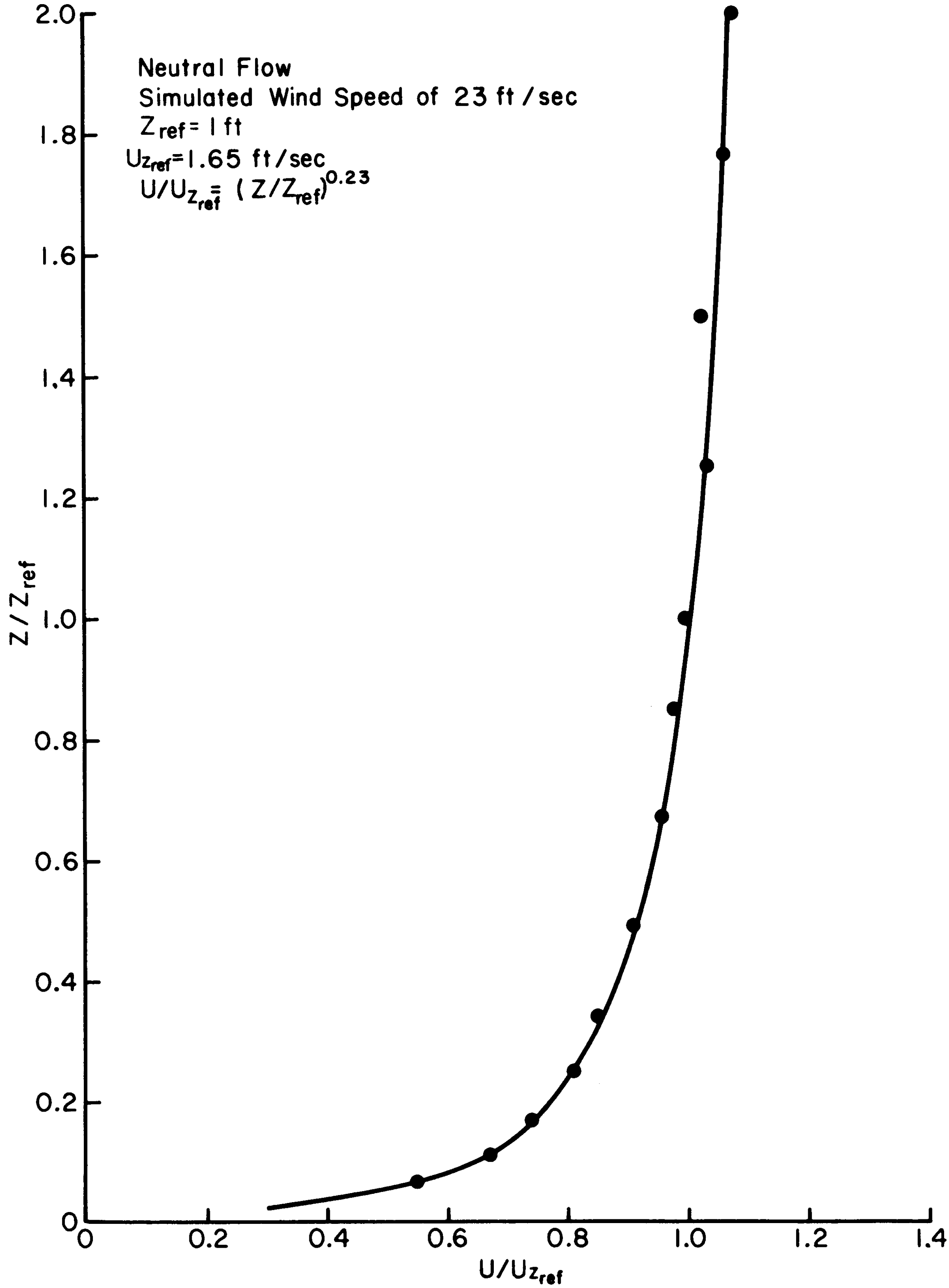


Figure 17 Velocity Profile, Neutral Flow at Higher of Wind Speeds. Meteorological Wind Tunnel

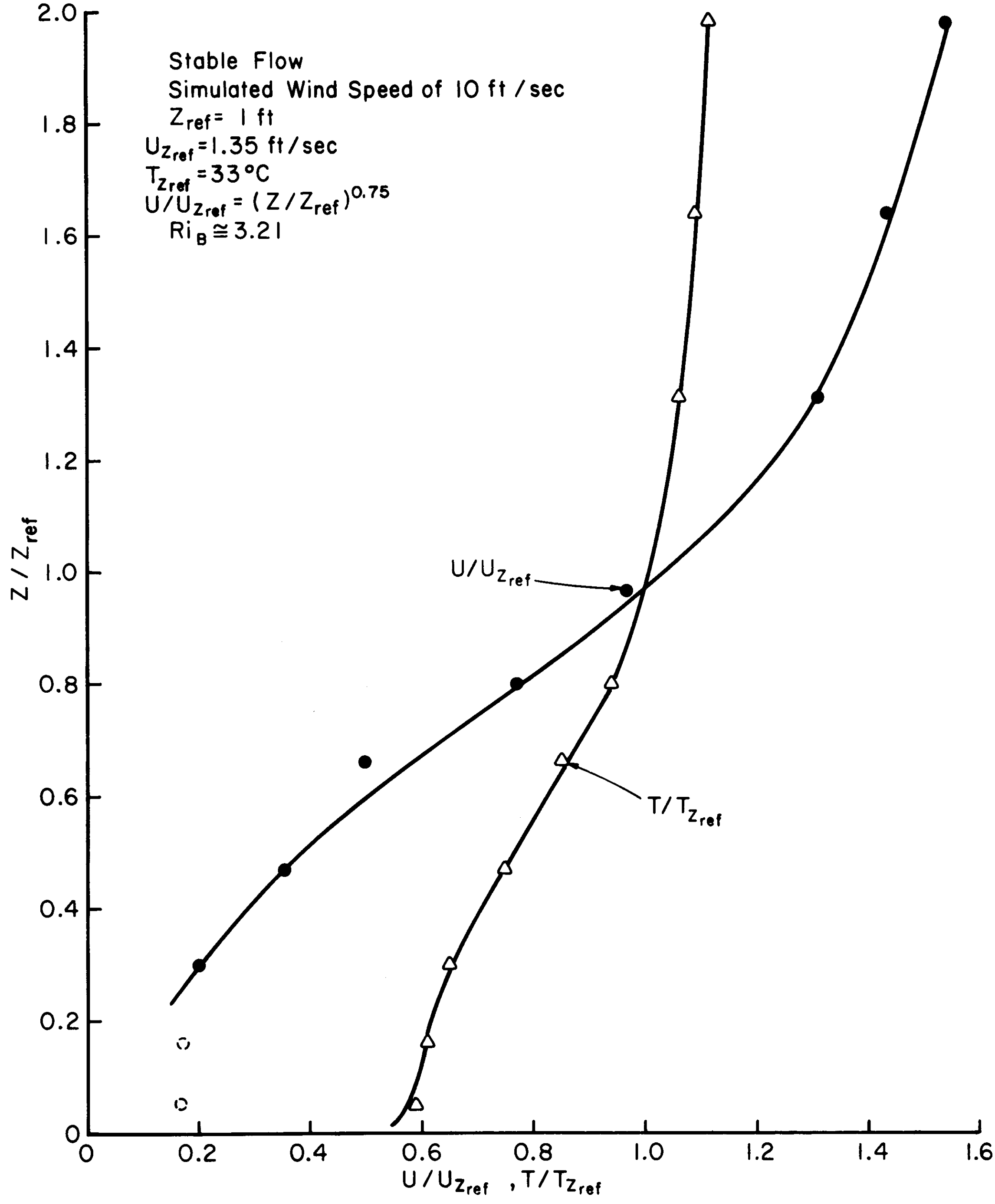


Figure 18 Velocity and Temperature Profile, Stable Flow at Lower of Wind Speeds. Meteorological Wind Tunnel

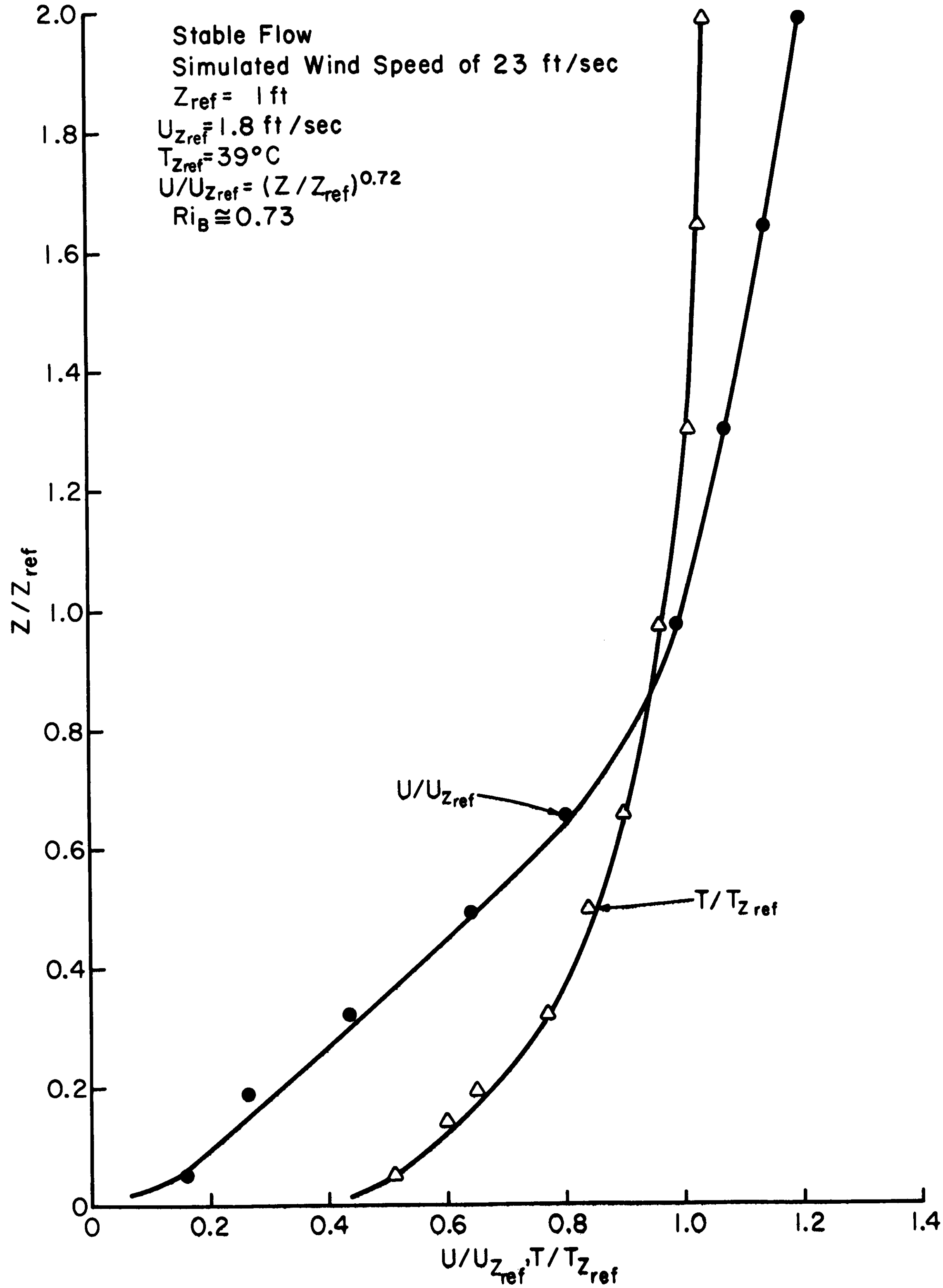


Figure 19 Velocity and Temperature Profile, Stable Flow at Higher of Wind Speeds. Meteorological Wind Tunnel

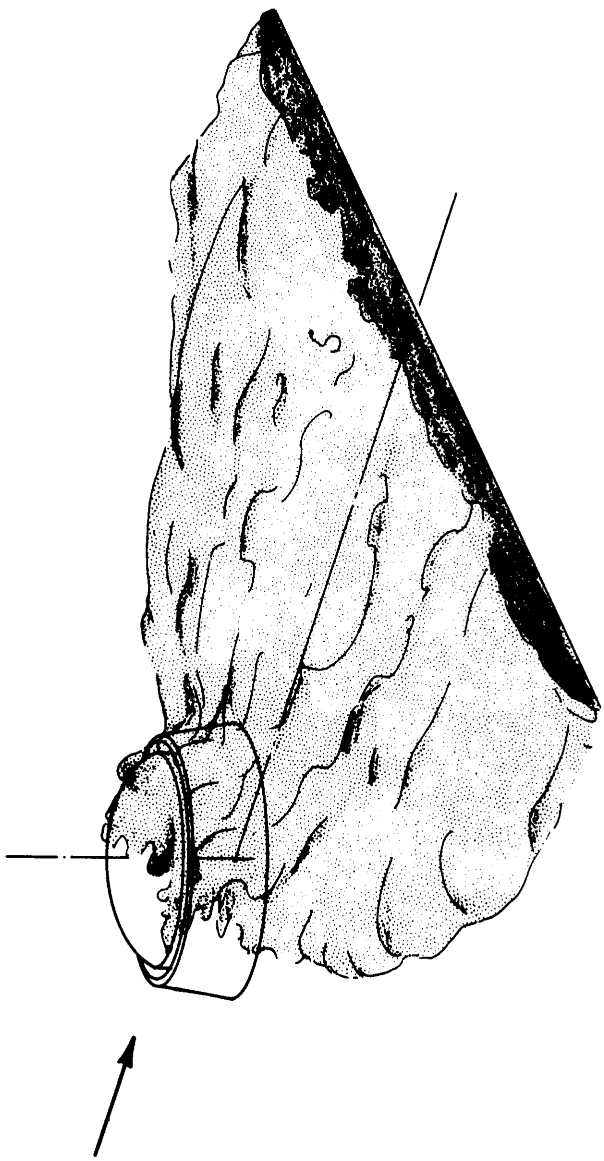


Figure 20 Visualization of Plume from High Dike Model.

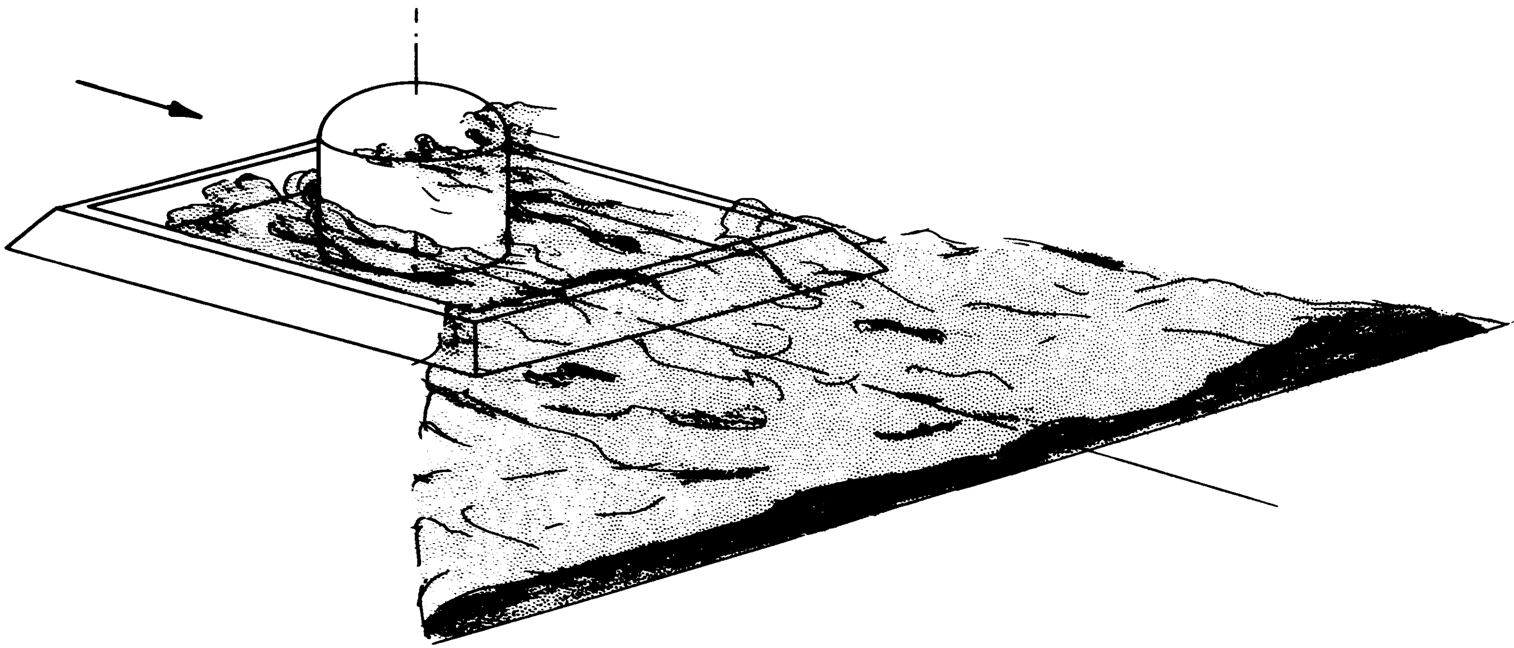


Figure 21   Visualization of Plume from Low Dike Model - Wind Direction 0°.

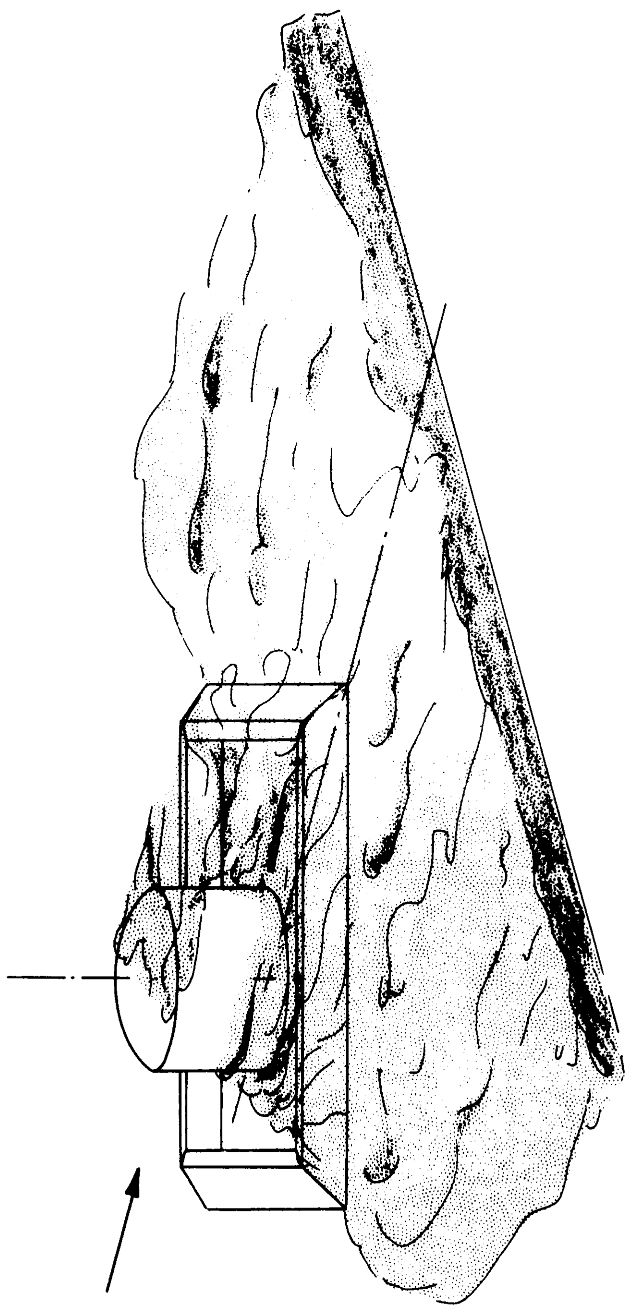
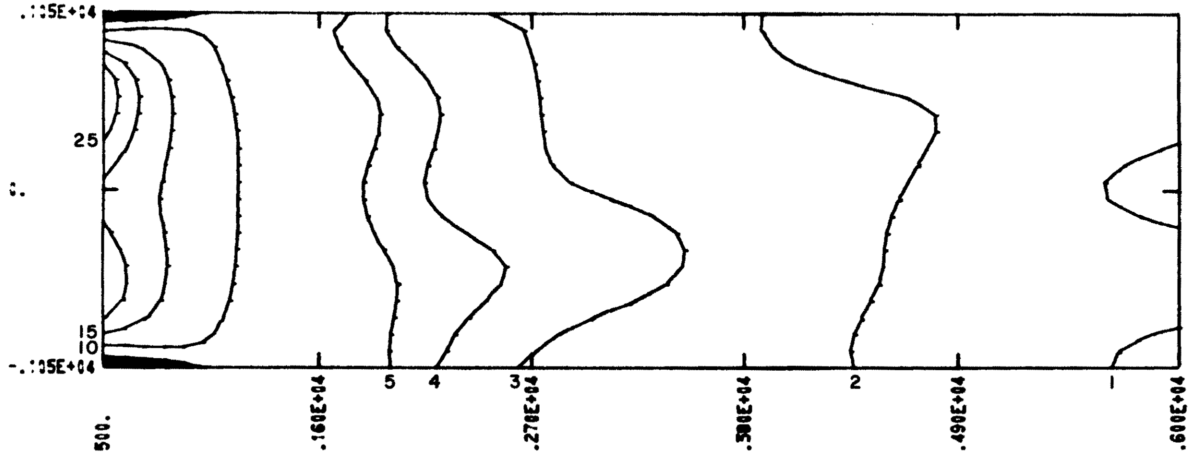
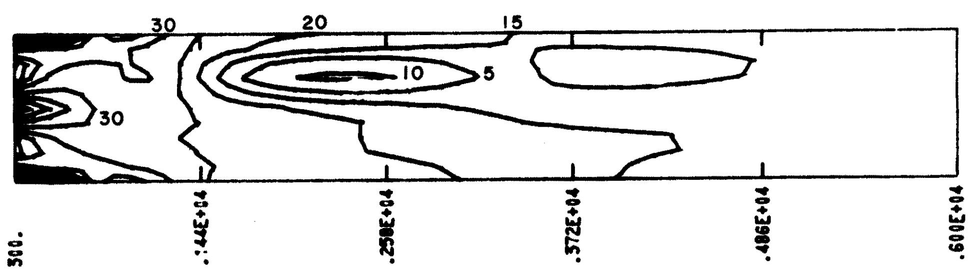


Figure 22 Visualization of Plume from Low Dike Model - Wind Direction 45°.

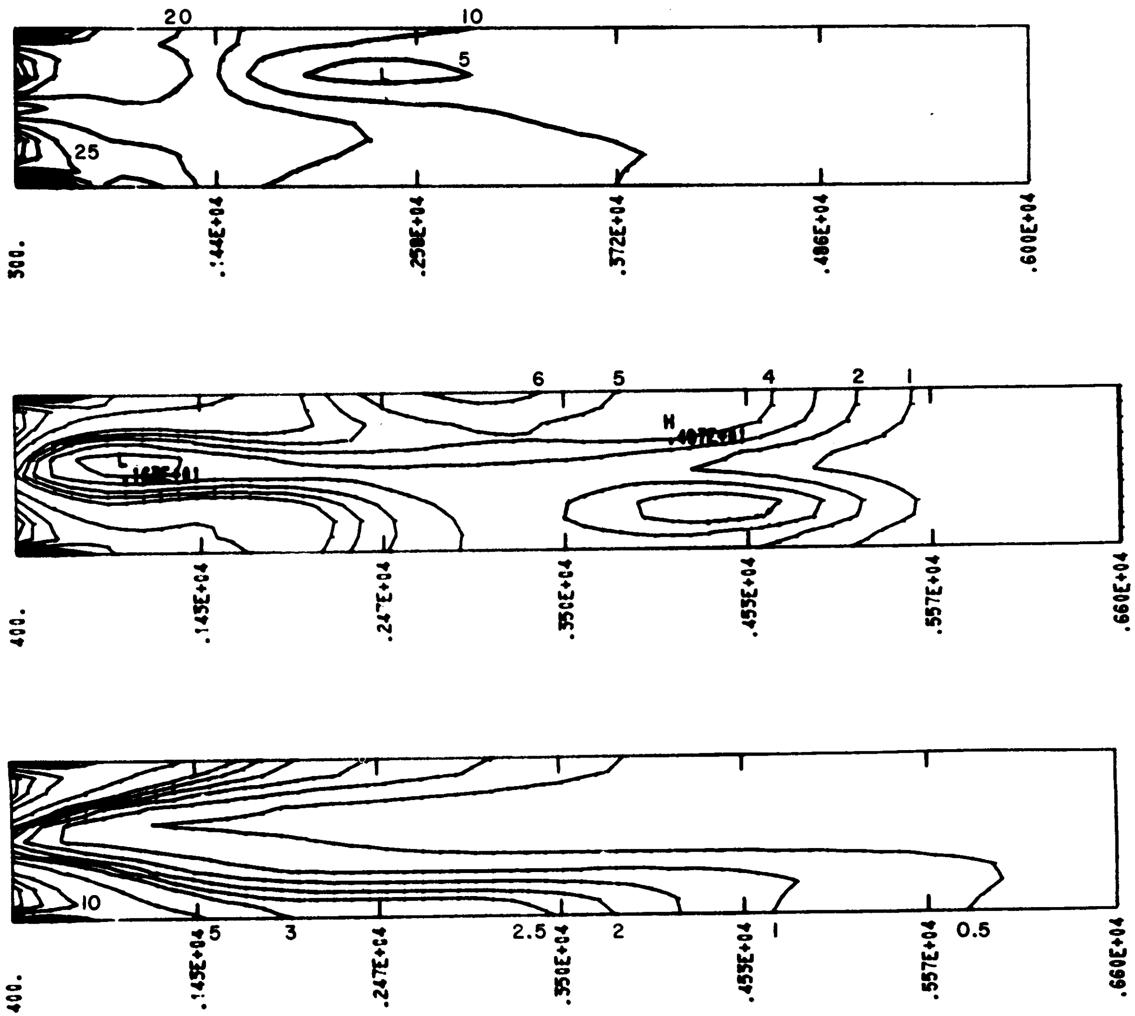


Run No. 101
Model Gas M.W. 40.6
High Dike 1:500
Strat. Neutral
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 3960 lbm/s



Run No. 1
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 3960 lbm/s

Figure No. 23-1 Ground Contours of Per Cent Methane Concentration.

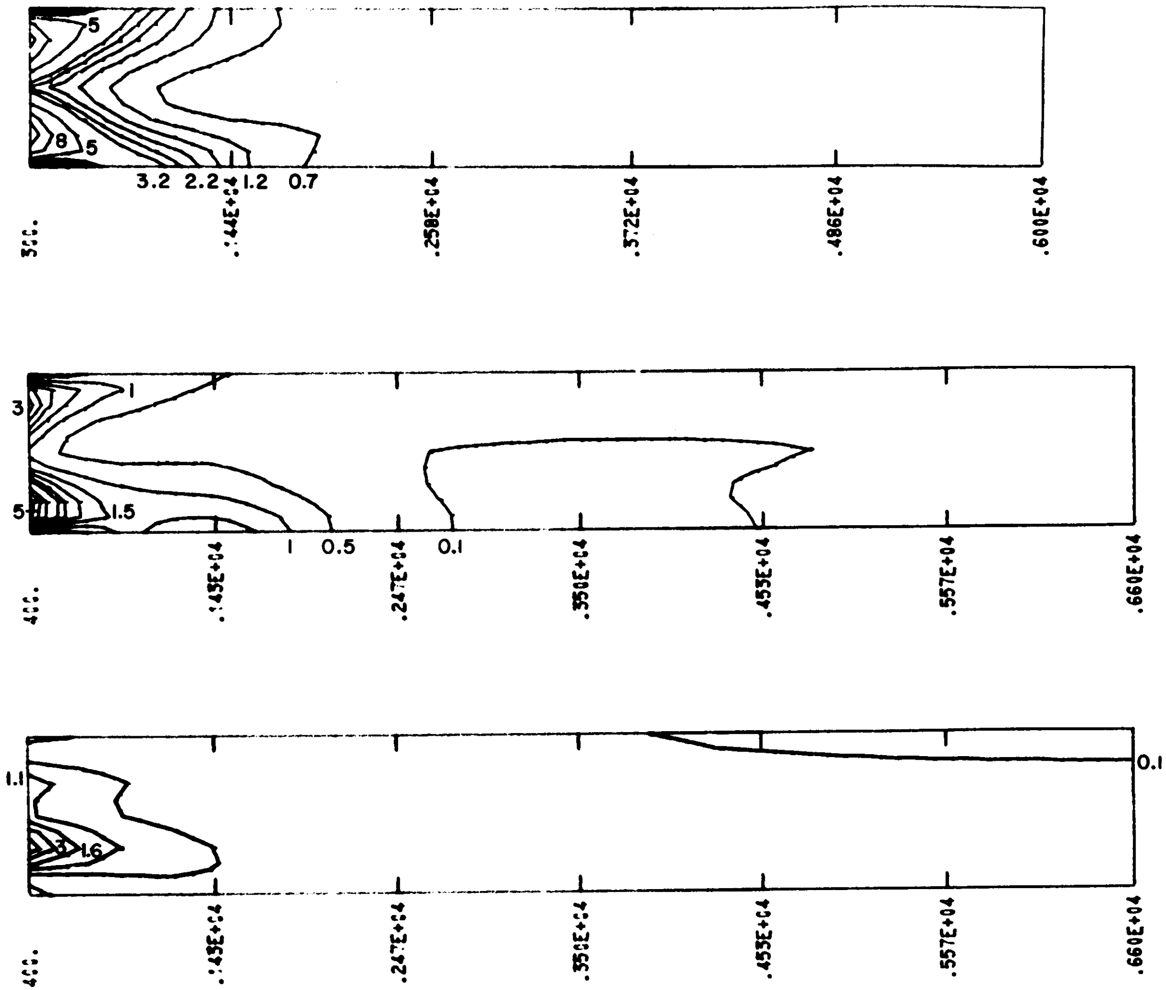


Run No. 2
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 2400 lbm/s

Run No. 202
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 16 ft/s
Boiloff 2400 lbm/s

Run No. 302
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 23 ft/s
Boiloff 2400 lbm/s

Figure No. 23-2 Ground Contours of Per Cent Methane Concentration.

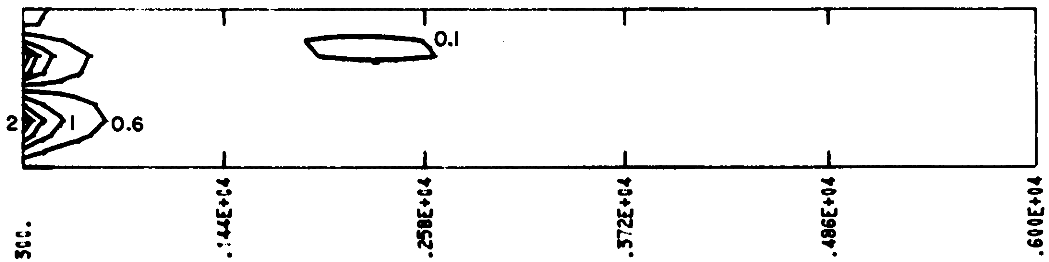


Run No. 3
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 420 lbm/s

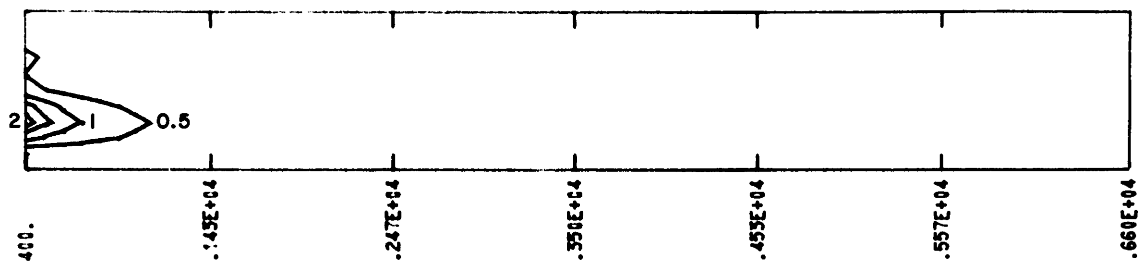
Run No. 203
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 16 ft/s
Boiloff 420 lbm/s

Run No. 303
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 23 ft/s
Boiloff 420 lbm/s

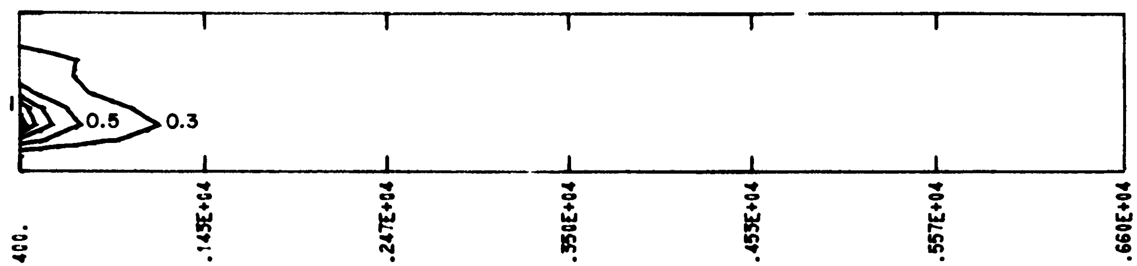
Figure No. 23-3 Ground Contours of Per Cent Methane Concentration.



Run No. 4
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 160 lbm/s

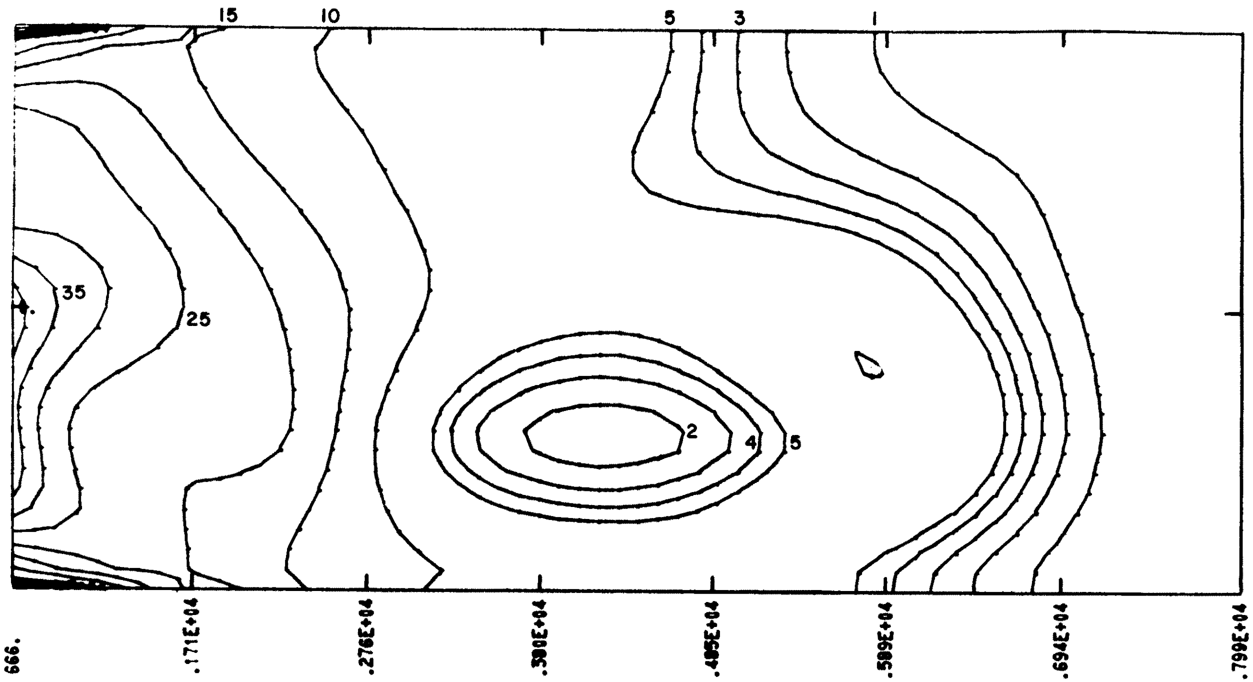


Run No. 204
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 16 ft/s
Boiloff 160 lbm/s

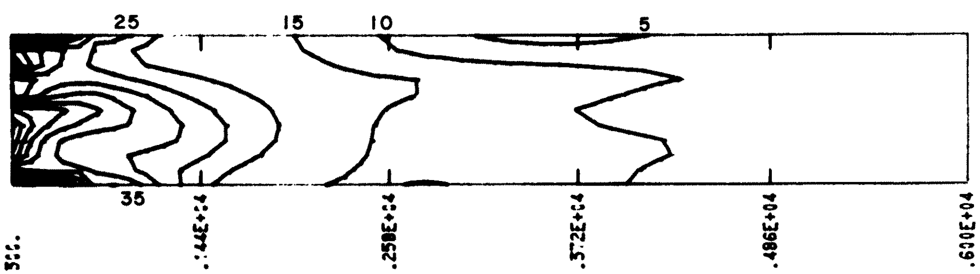


Run No. 304
Model Gas M.W. 40.6
High Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 23 ft/s
Boiloff 160 lbm/s

Figure No. 23-4 Ground Contours of Per Cent Methane Concentration.

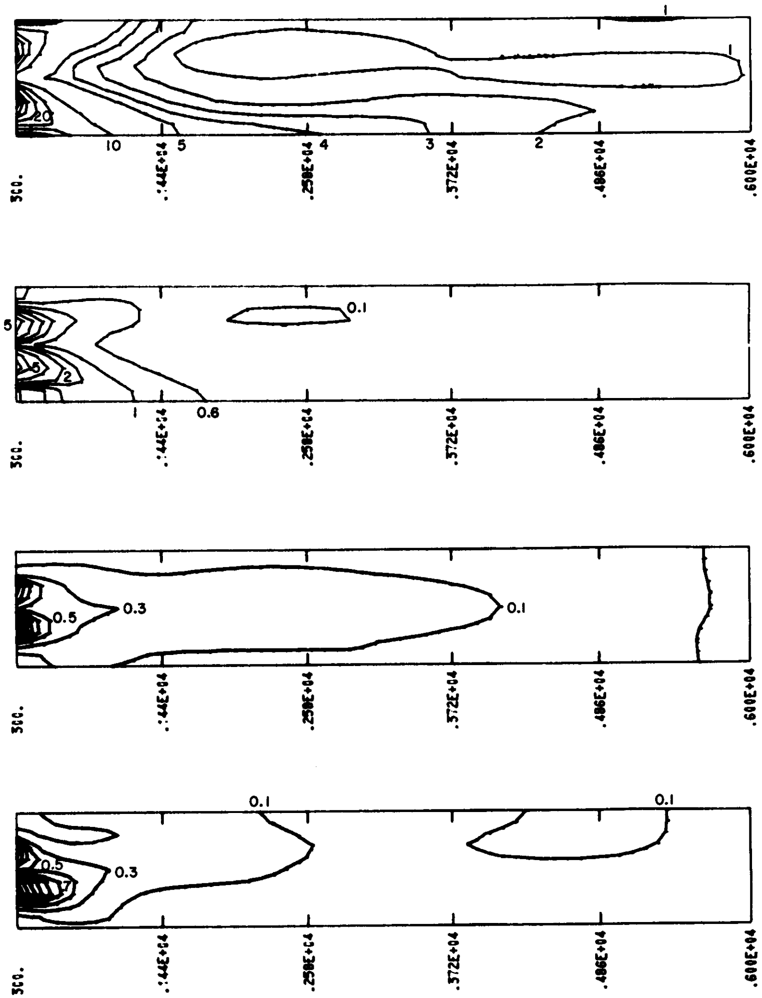


Run No. 110
Model Gas M.W. 40.6
Low Dike 1:666
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 2534 lbm/s



Run No. 10
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 2534 lbm/s

Figure No. 23-5 Ground Contours of Per Cent Methane Concentration.



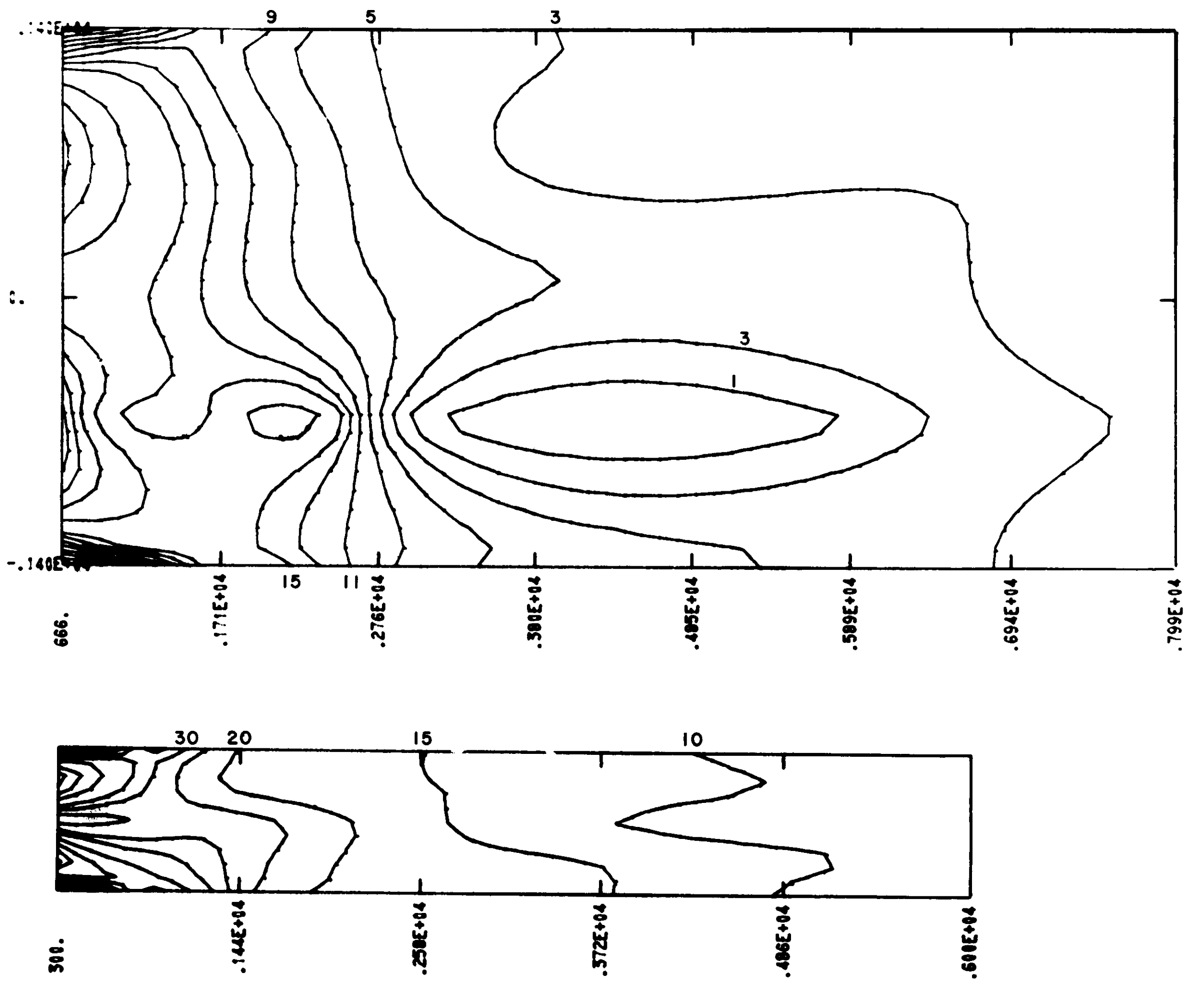
Run No. 11
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 850 lbm/s

Run No. 12
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 275 lbm/s

Run No. 13
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 116 lbm/s

Run No. 14
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 94 lbm/s

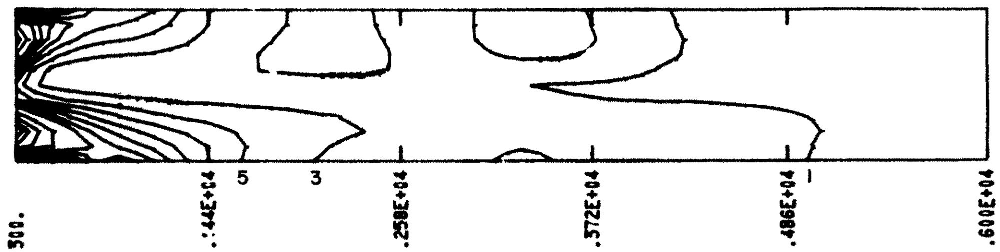
Figure No. 23-6 Ground Contours of Per Cent Methane Concentration.



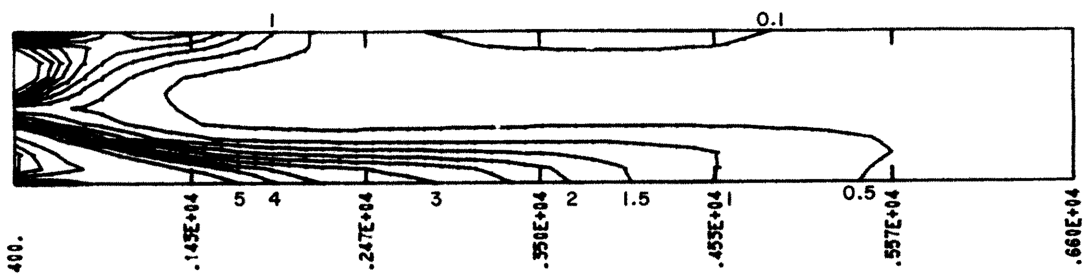
Run No. 115
Model Gas M.W. 40.6
Low Dike 1:666
Strat. Neutral
Wind Dir. 45°
Wind Speed 10 ft/s
Boiloff 2534 lbm/s

Run No. 15
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 10 ft/s
Boiloff 2534 lbm/s

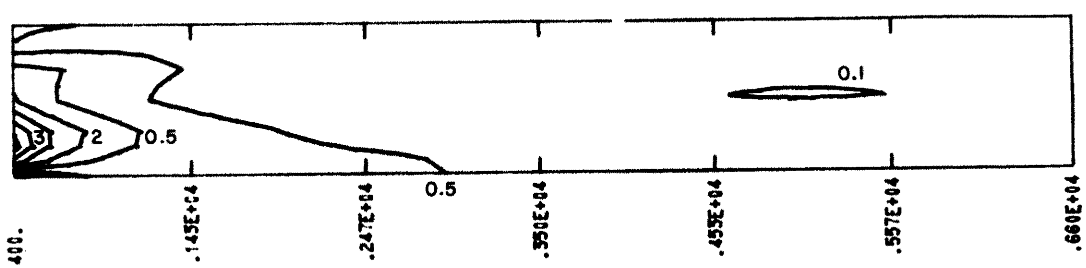
Figure No. 23-7 Ground Contours of Per Cent Methane Concentration.



Run No. 16
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 10 ft/s
Boiloff 850 lbm/s

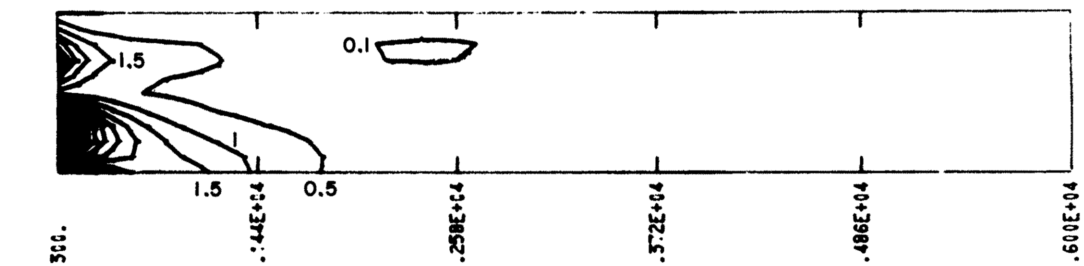


Run No. 216
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 16 ft/s
Boiloff 850 lbm/s

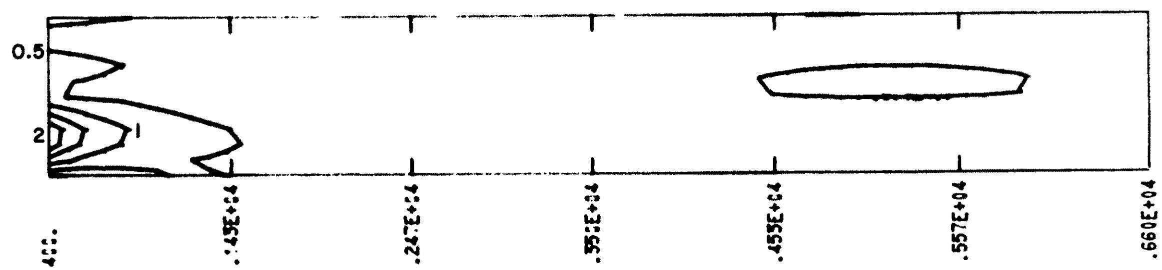


Run No. 316
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 23 ft/s
Boiloff 850 lbm/s

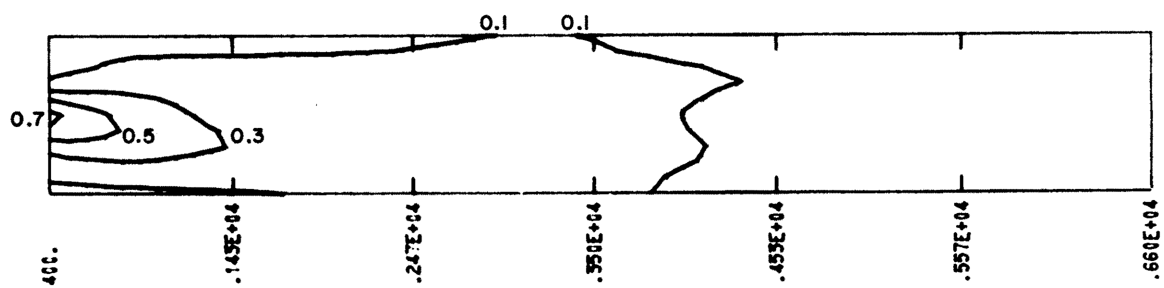
Figure No. 23-8 Ground Contours of Per Cent Methane Concentration.



Run No. 17
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 10 ft/s
Boiloff 275 lbm/s

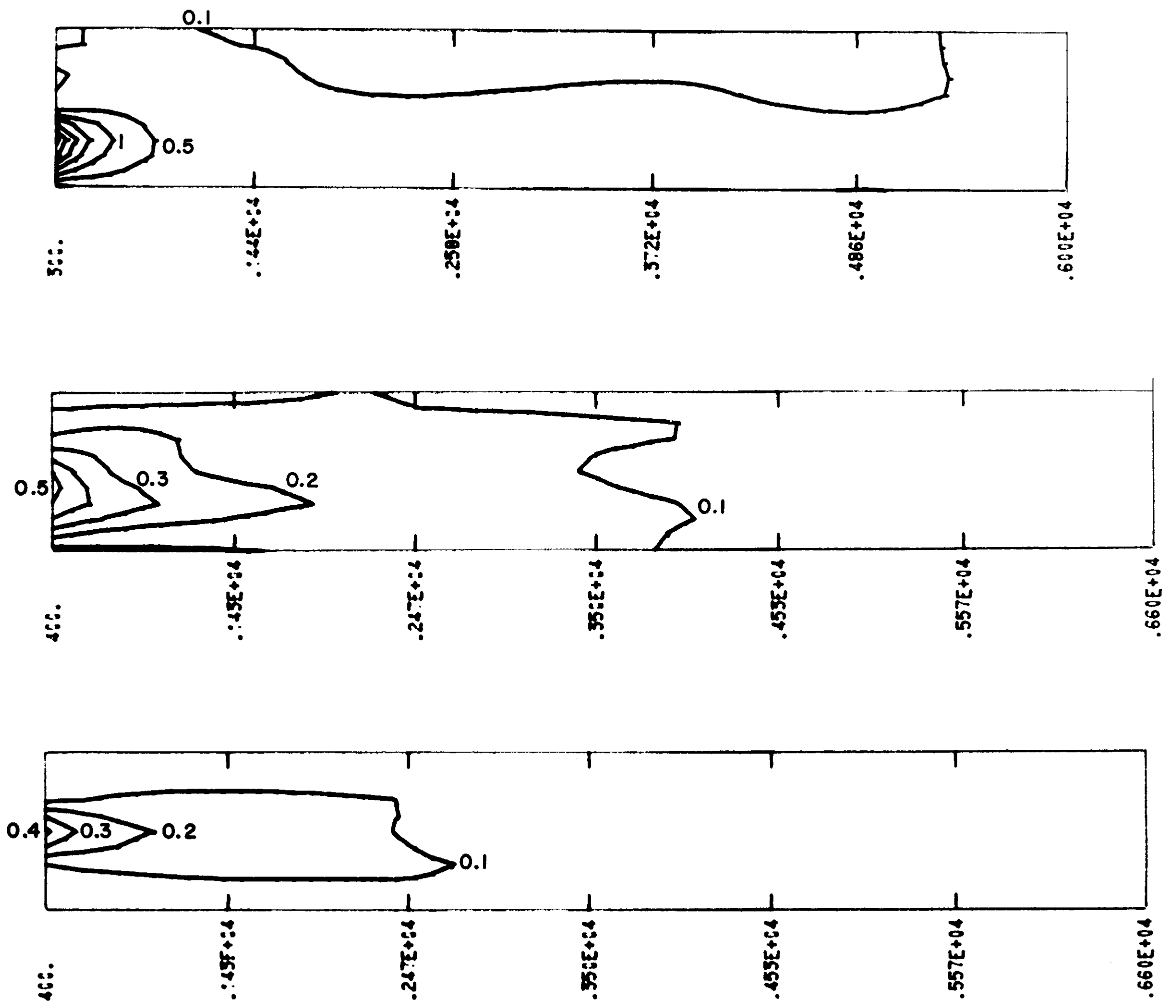


Run No. 217
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 16 ft/s
Boiloff 275 lbm/s



Run No. 317
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 23 ft/s
Boiloff 275 lbm/s

Figure No. 23-9 Ground Contours of Per Cent Methane Concentration.

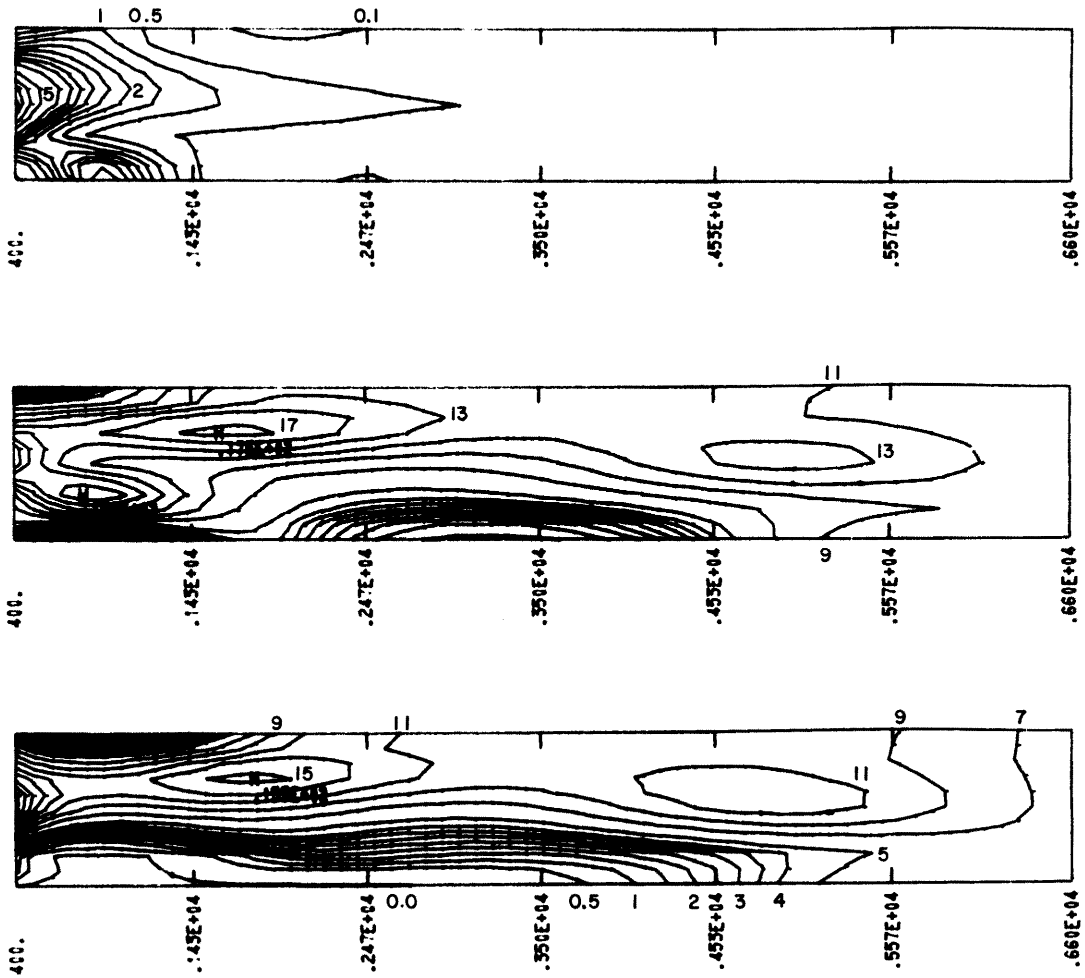


Run No. 18
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 10 ft/s
Boiloff 116 lbm/s

Run No. 218
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 16 ft/s
Boiloff 116 lbm/s

Run No. 318
Model Gas M.W. 40.6
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 23 ft/s
Boiloff 116 lbm/s

Figure No. 23-10 Ground Contours of Per Cent Methane Concentration.

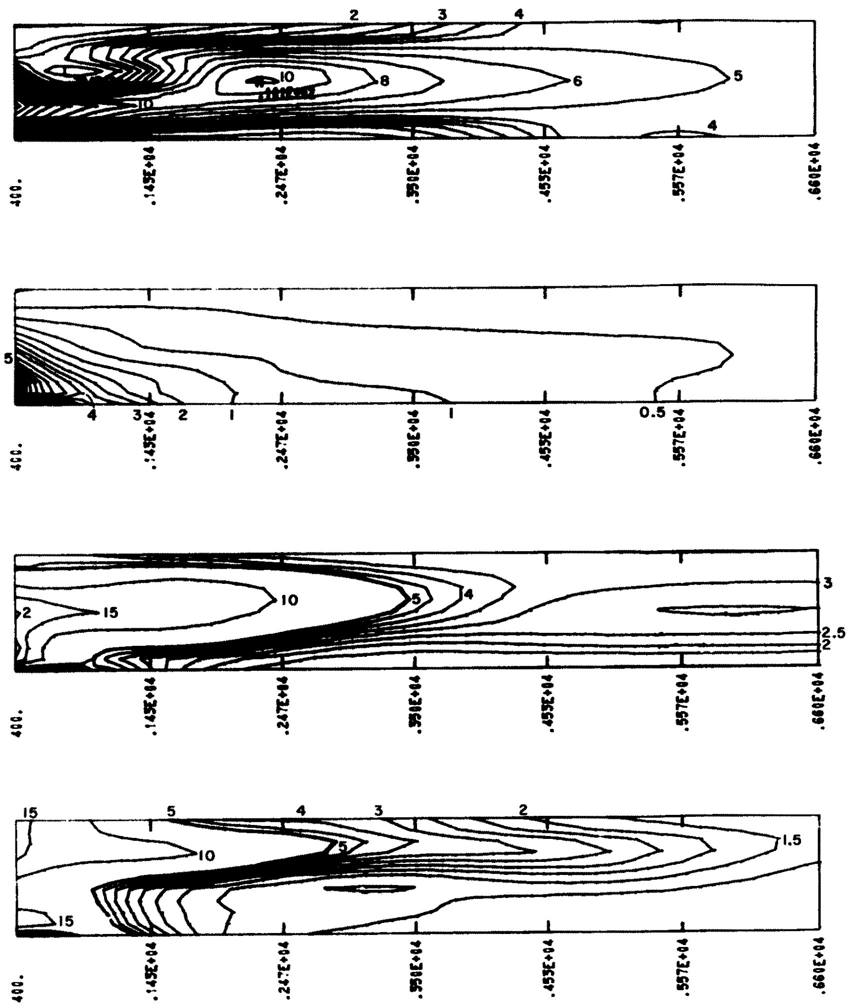


Run No. 302C
Model Gas M.W. 16
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 23 ft/s
Boiloff 2400 lbm/s

Run No. 22C
Model Gas M.W. 16
High Dike 1:200
Strat. Stable
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 2400 lbm/s

Run No. 322C
Model Gas M.W. 16
High Dike 1:200
Strat. Stable
Wind Dir. 0^{o}
Wind Speed 23 ft/s
Boiloff 2400 lbm/s

Figure No. 23-11 Ground Contours of Per Cent Methane Concentration.



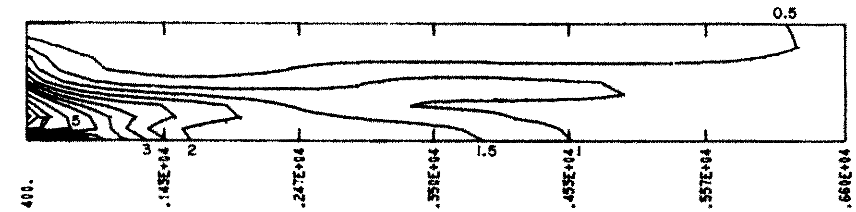
Run No. 3C
Model Gas M.W. 16
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 420 lbm/s

Run No. 303C
Model Gas M.W. 16
High Dike 1:200
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 23 ft/s
Boiloff 420 lbm/s

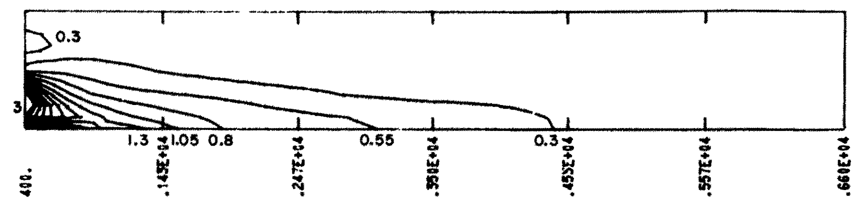
Run No. 23C
Model Gas M.W. 16
High Dike 1:200
Strat. Stable
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 420 lbm/s

Run No. 323C
Model Gas M.W. 16
High Dike 1:200
Strat. Stable
Wind Dir. 0^{o}
Wind Speed 23 ft/s
Boiloff 420 lbm/s

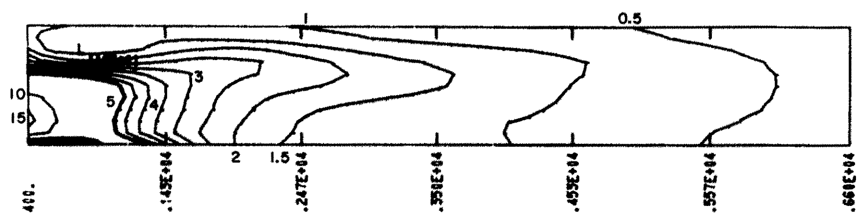
Figure No. 23-12 Ground Contours of Per Cent Methane Concentration.



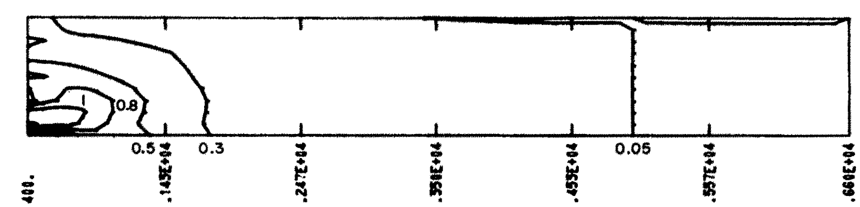
Run No. 4C
Model Gas M.W. 16
High Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 160 lbm/s



Run No. 304C
Model Gas M.W. 16
High Dike 1:200
Strat. Neutral
Wind Dir. 0°
Wind Speed 23 ft/s
Boiloff 160 lbm/s

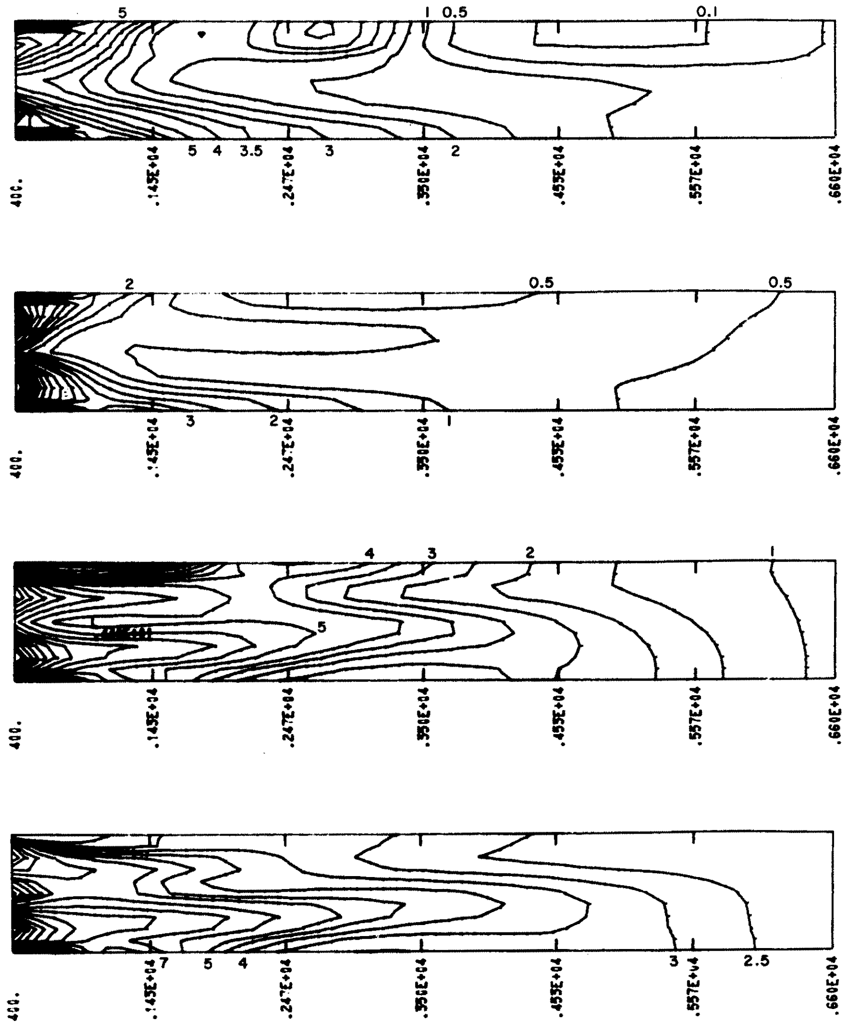


Run No. 24C
Model Gas M.W. 16
High Dike 1:200
Strat. Stable
Wind Dir. 0°
Wind Speed 10 ft/s
Boiloff 160 lbm/s



Run No. 324C
Model Gas M.W. 16
High Dike 1:200
Strat. Stable
Wind Dir. 0°
Wind Speed 23 ft/s
Boiloff 160 lbm/s

Figure No. 23-13 Ground Contours of Per Cent Methane Concentration.



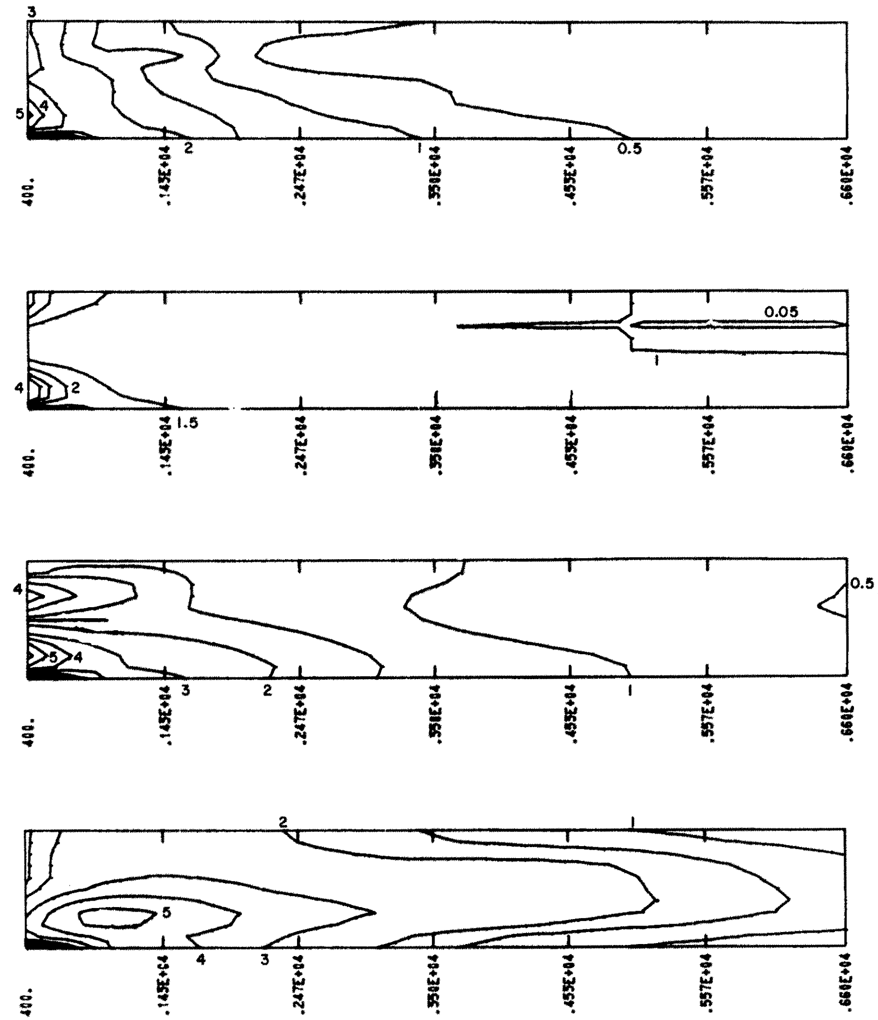
Run No. 16C
Model Gas M.W. 16
Low Dike 1:200
Strat. Neutral
Wind Dir. 45^{o}
Wind Speed 10 ft/s
Boiloff 850 lbm/s

Run No. 316C
Model Gas M.W. 16
Low Dike 1:200
Strat. Neutral
Wind Dir. 45^{o}
Wind Speed 23 ft/s
Boiloff 850 lbm/s

Run No. 36C
Model Gas M.W. 16
Low Dike 1:200
Strat. Stable
Wind Dir. 45^{o}
Wind Speed 10 ft/s
Boiloff 850 lbm/s

Run No. 336C
Model Gas M.W. 16
Low Dike 1:200
Strat. Stable
Wind Dir. 45^{o}
Wind Speed 23 ft/s
Boiloff 850 lbm/s

Figure No. 23-14 Ground Contours of Per Cent Methane Concentration.



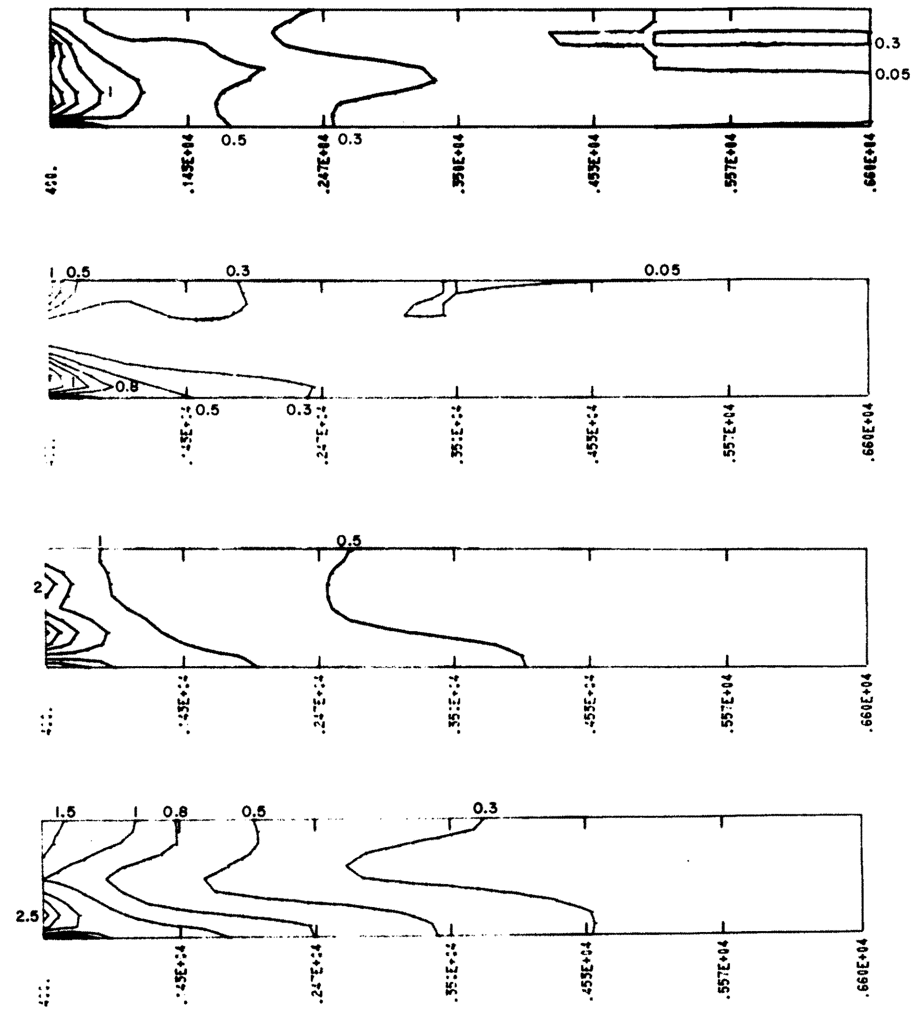
Run No. 17C
Model Gas M.W. 16
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 10ft/s
Boiloff 275 lbm/s

Run No. 317C
Model Gas M.W. 16
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 23 ft/s
Boiloff 275 lbm/s

Run No. 37C
Model Gas M.W. 16
Low Dike 1:200
Strat. Stable
Wind Dir. 45°
Wind Speed 10 ft/s
Boiloff 275 lbm/s

Run No. 337C
Model Gas M.W. 16
Low Dike 1:200
Strat. Stable
Wind Dir. 45°
Wind Speed 23 ft/s
Boiloff 275 lbm/s

Figure No. 23-15 Ground Contours of Per Cent Methane Concentration.



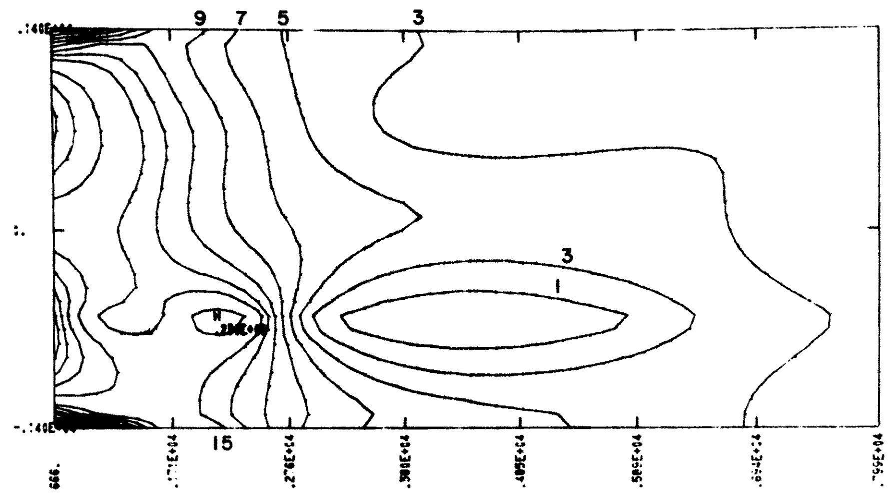
Run No. 18C
Model Gas M.W. 16
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 10 ft/s
Boiloff 116 lbm/s

Run No. 318C
Model Gas M.W. 16
Low Dike 1:200
Strat. Neutral
Wind Dir. 45°
Wind Speed 23 ft/s
Boiloff 116 lbm/s

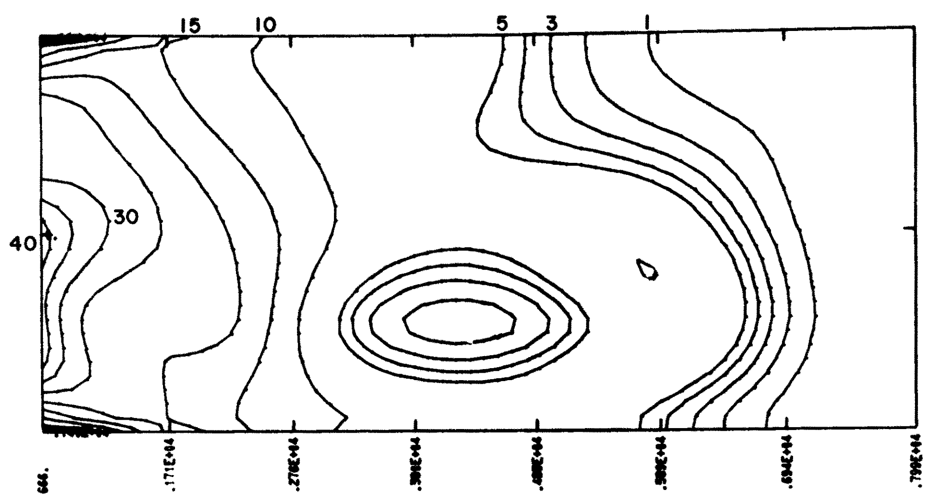
Run No. 38C
Model Gas M.W. 16
Low Dike 1:200
Strat. Stable
Wind Dir. 45°
Wind Speed 10 ft/s
Boiloff 116 lbm/s

Run No. 338C
Model Gas M.W. 16
Low Dike 1:200
Strat. Stable
Wind Dir. 45°
Wind Speed 23 ft/s
Boiloff 116 lbm/s

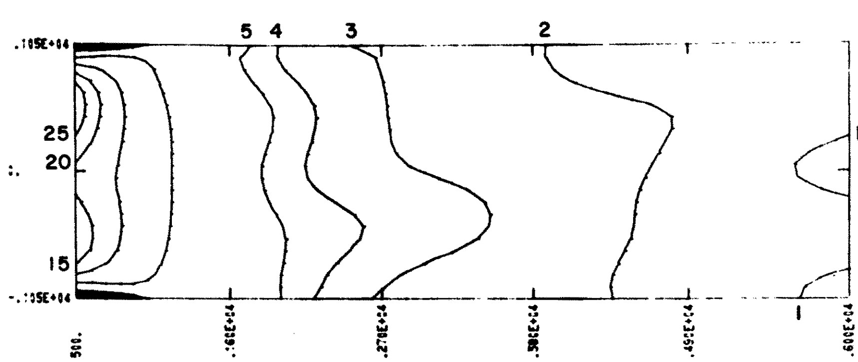
Figure No. 23-16 Ground Contours of Per Cent Methane Concentration.



Run No. 115
Model Gas M.W. 40.6
Low Dike 1:666
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 2534 lbm/s



Run No. 110
Model Gas M.W. 40.6
Low Dike 1:666
Strat. Neutral
Wind Dir. 45^{o}
Wind Speed 10 ft/s
Boiloff 2534 lbm/s



Run No. 101
Model Gas M.W. 40.6
High Dike 1:500
Strat. Neutral
Wind Dir. 0^{o}
Wind Speed 10 ft/s
Boiloff 3960 lbm/s

Figure No. 23-17 Ground Contours of Per Cent Methane Concentration.

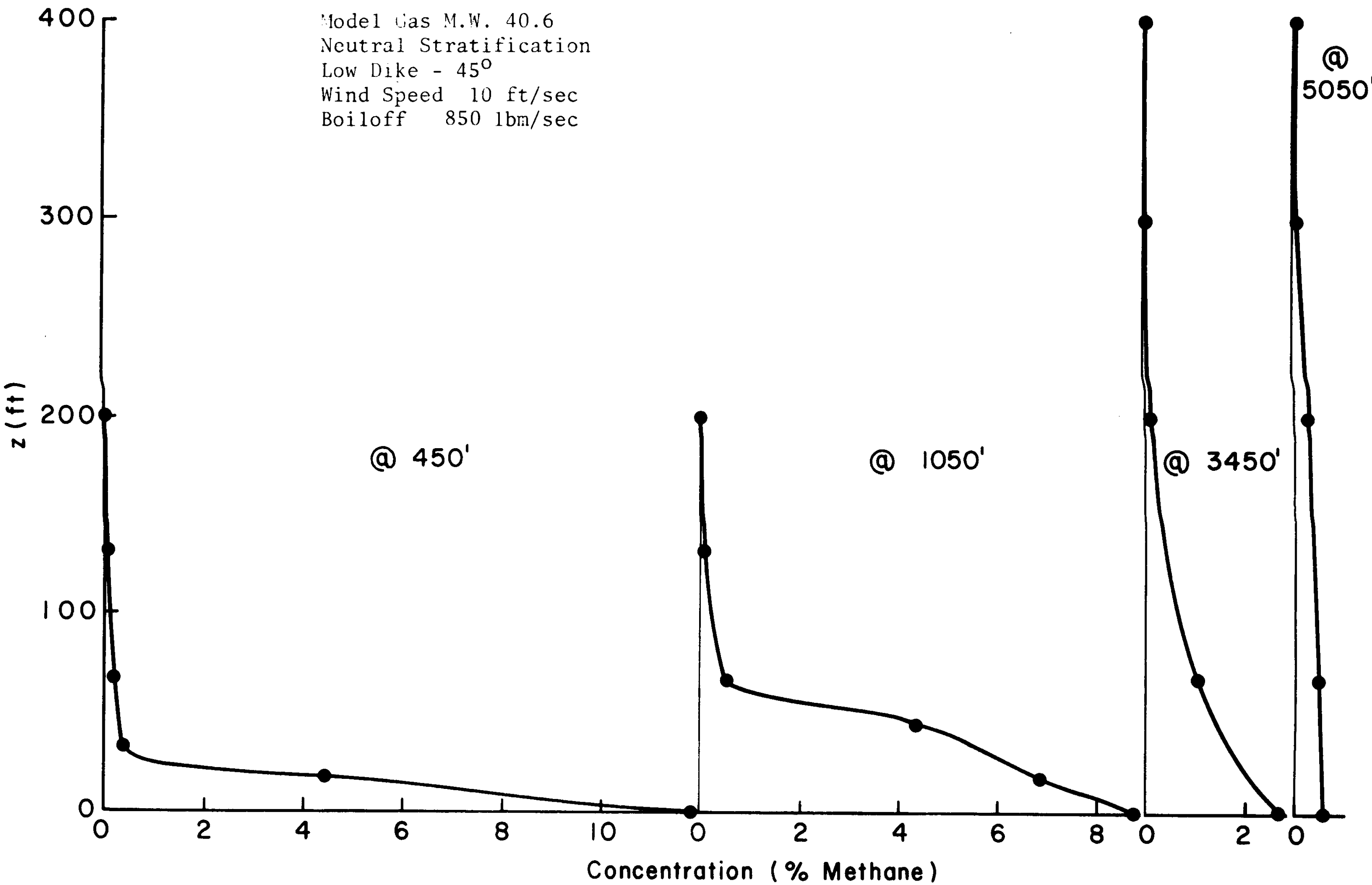


Figure 24-1 Vertical Concentration Profiles at Different Distances from Release

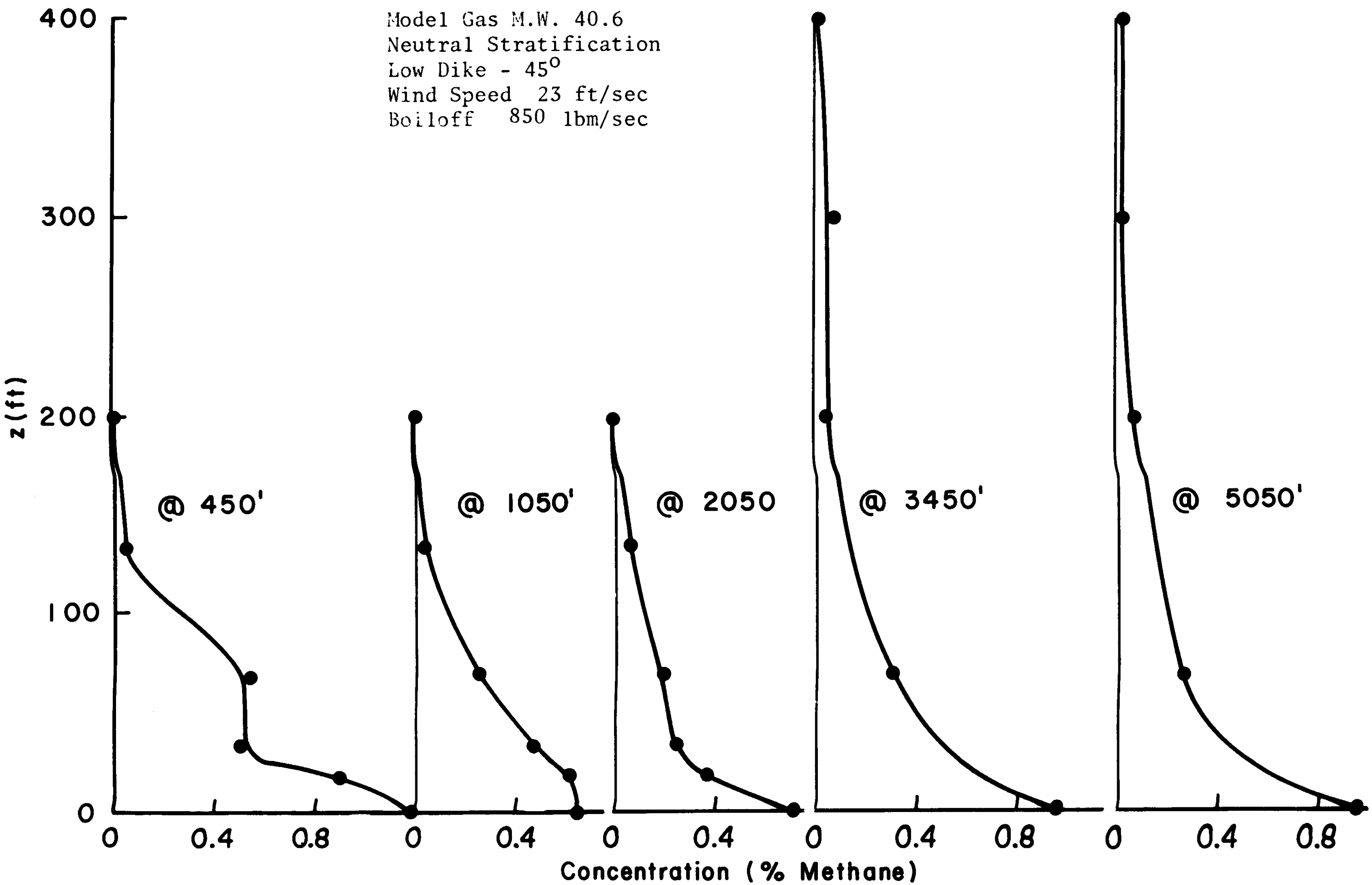


Figure 24-2 Vertical Concentration Profiles at Different Distances from Release

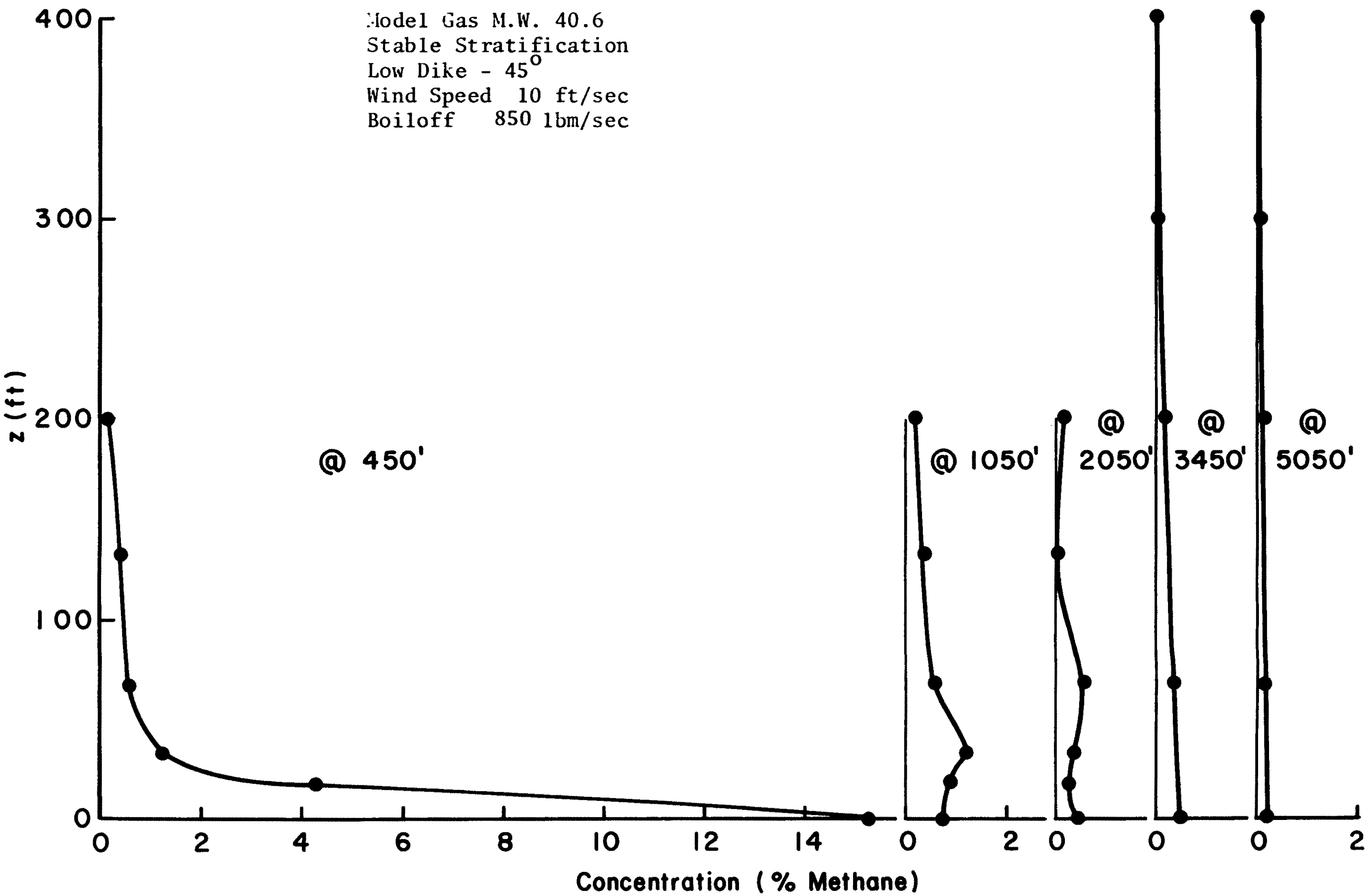


Figure 24-3 Vertical Concentration Profiles at Different Distances from Release

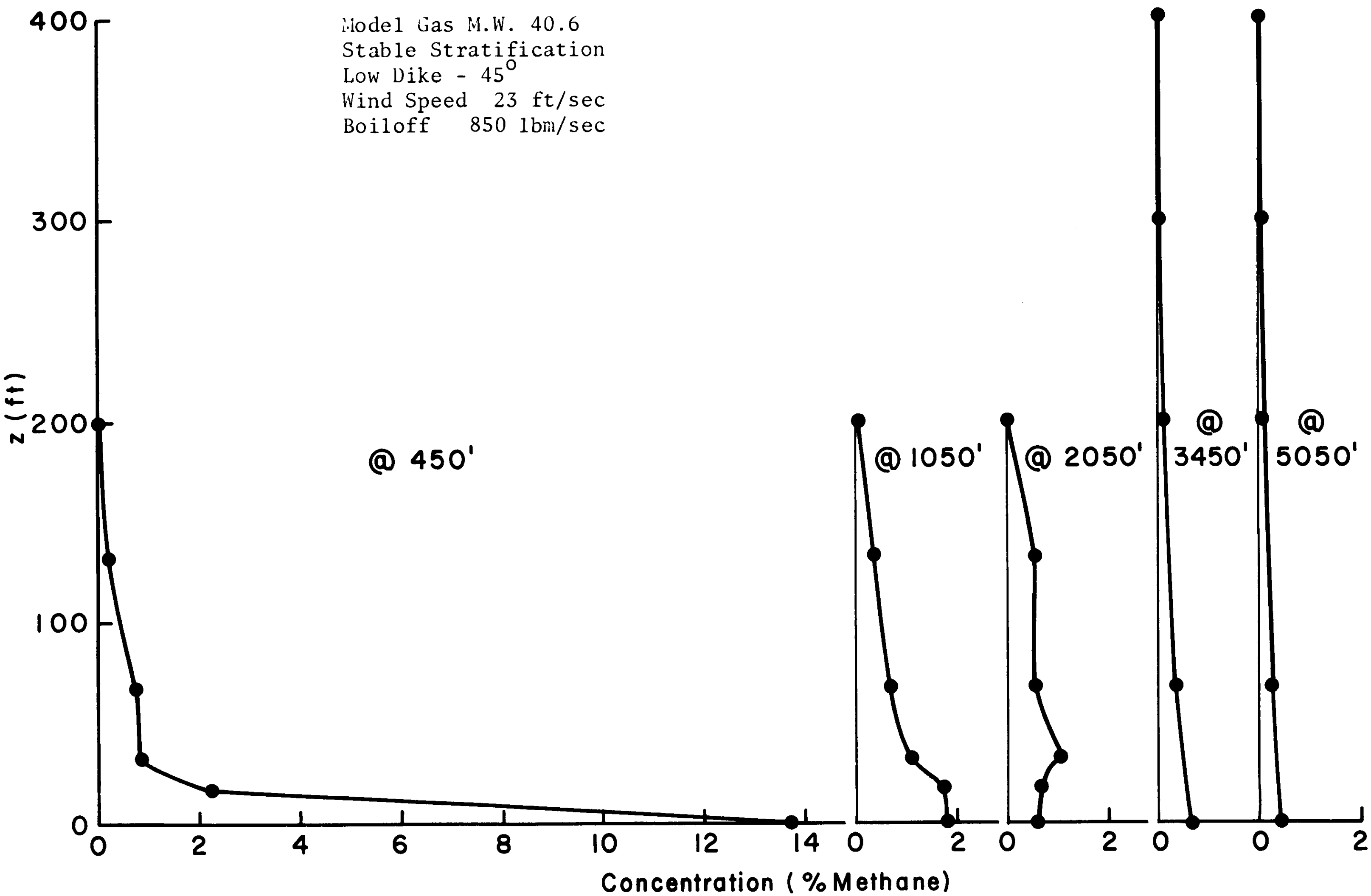


Figure 24-4 Vertical Concentration Profiles at Different Distances from Release

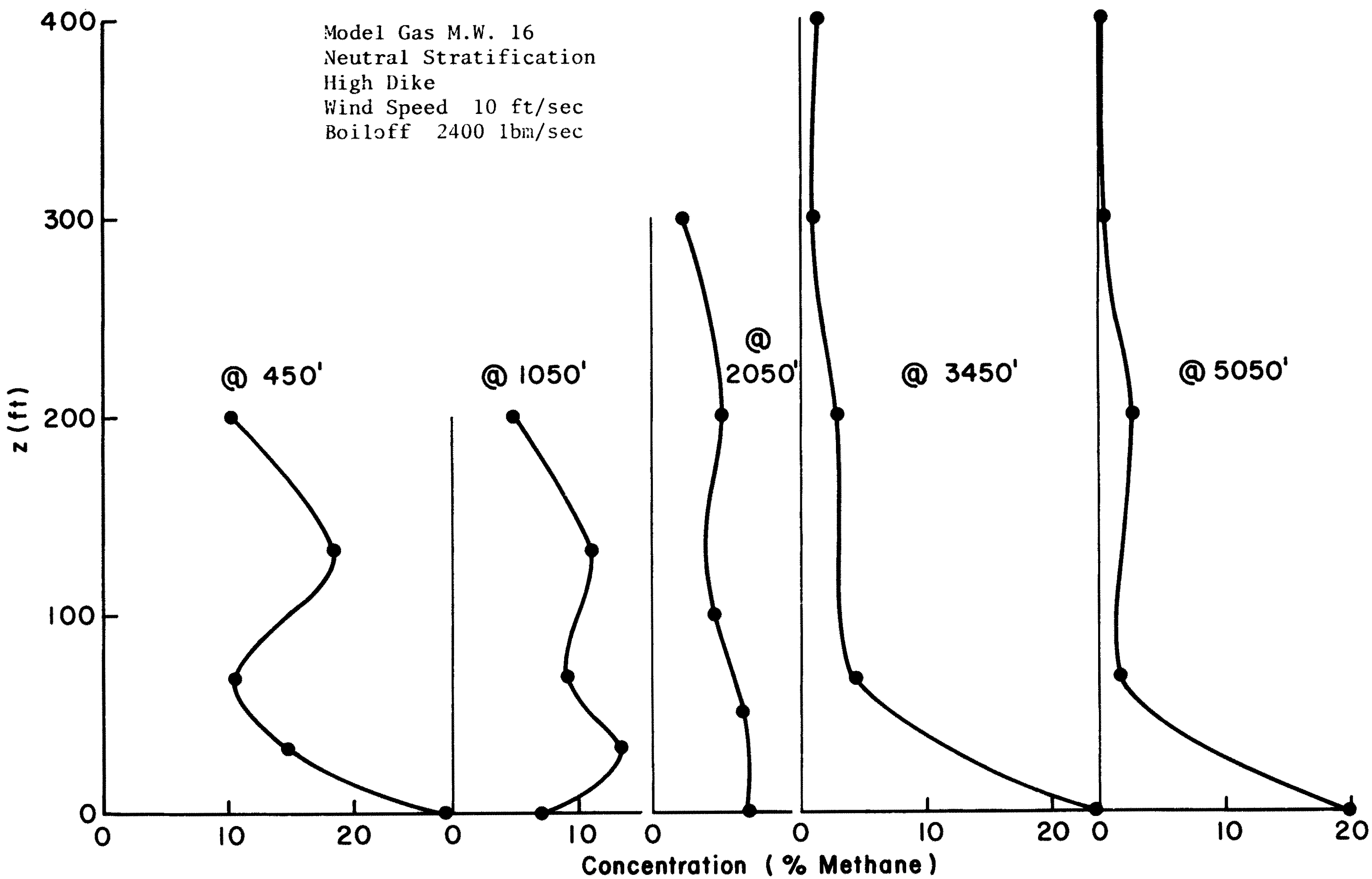


Figure 24-A Vertical Concentration Profiles at Different Distances from Release

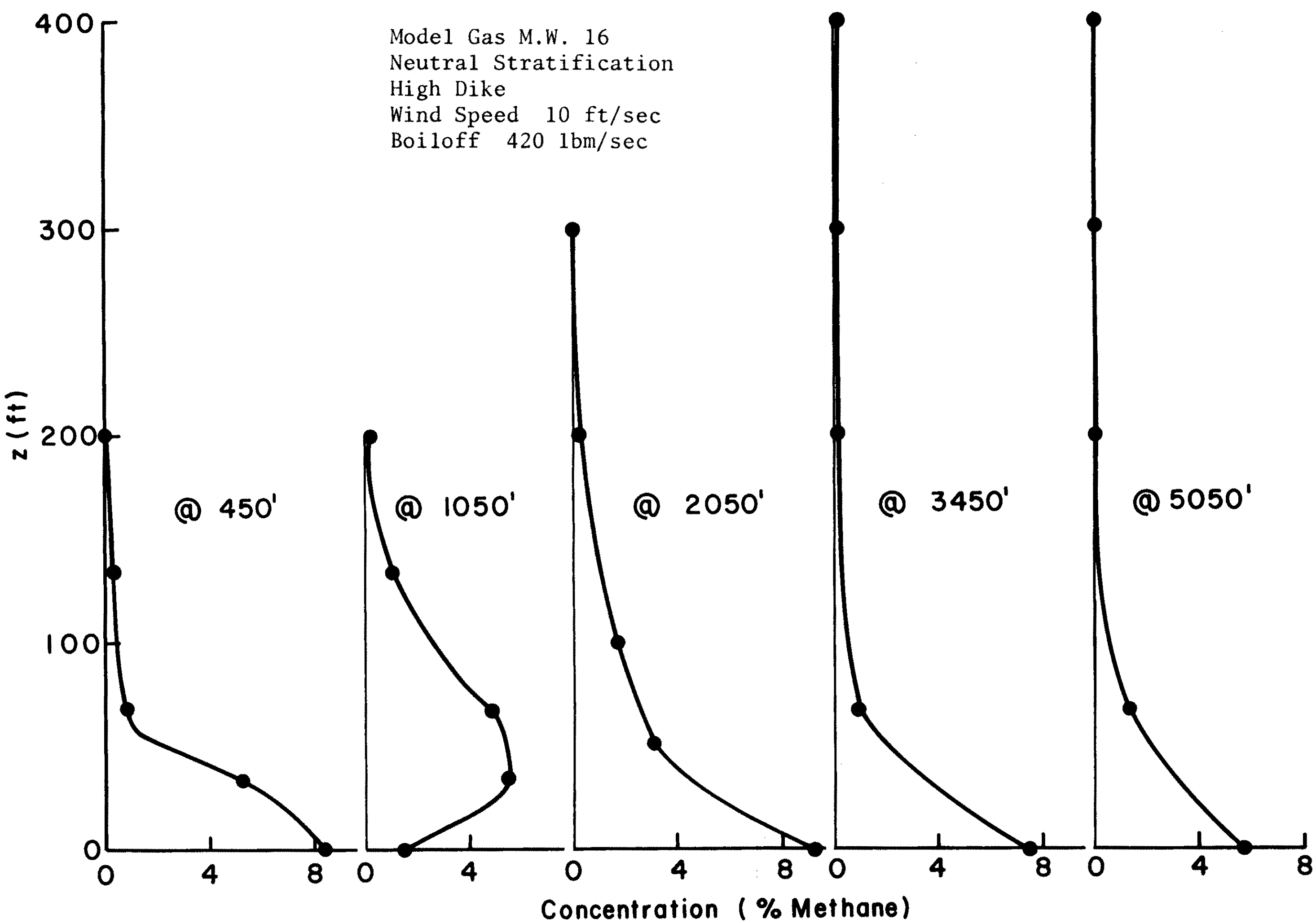


Figure 24-B Vertical Concentration Profiles at Different Distances from Release

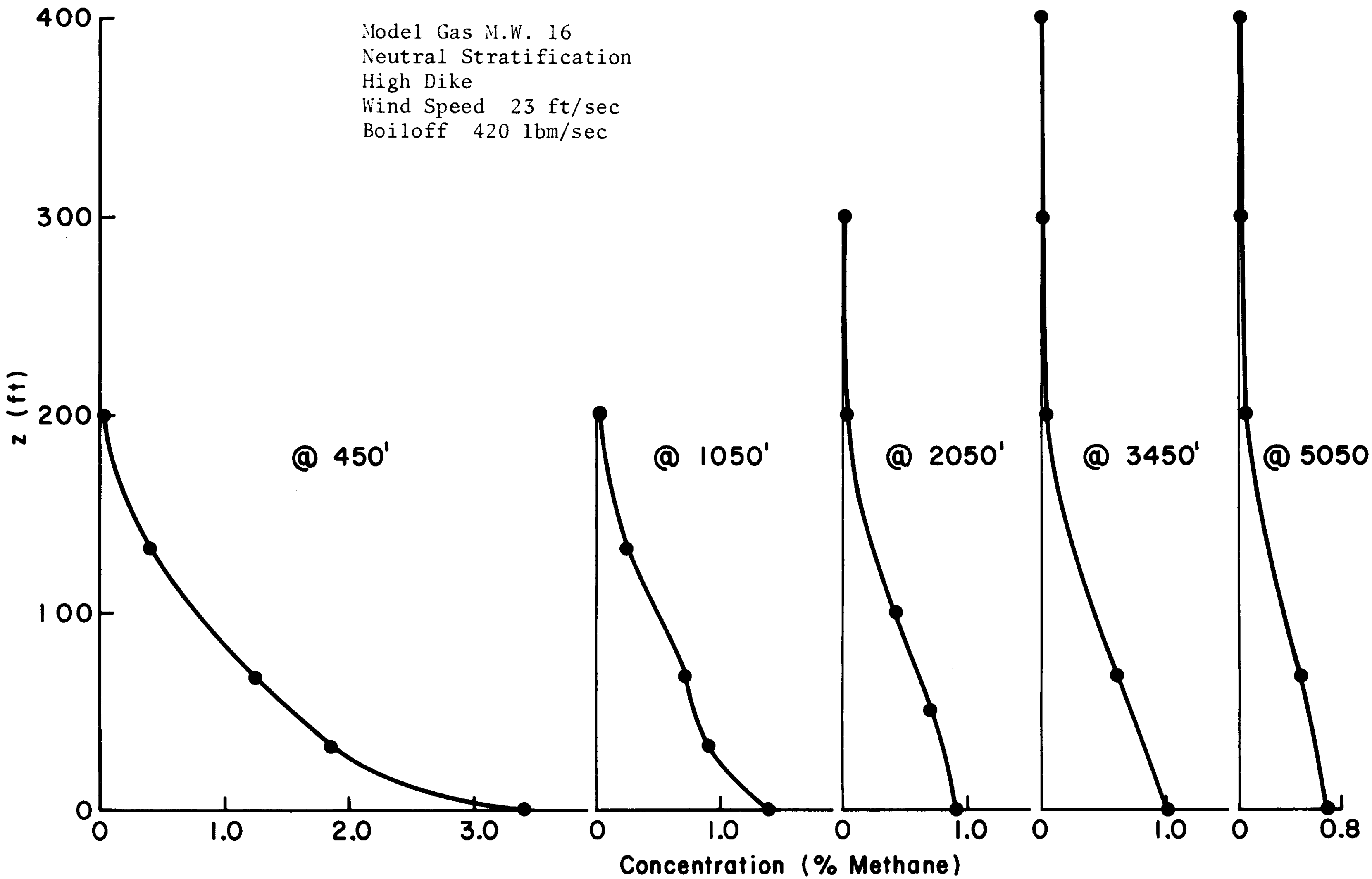


Figure 24-C Vertical Concentration Profiles at Different Distances from Release

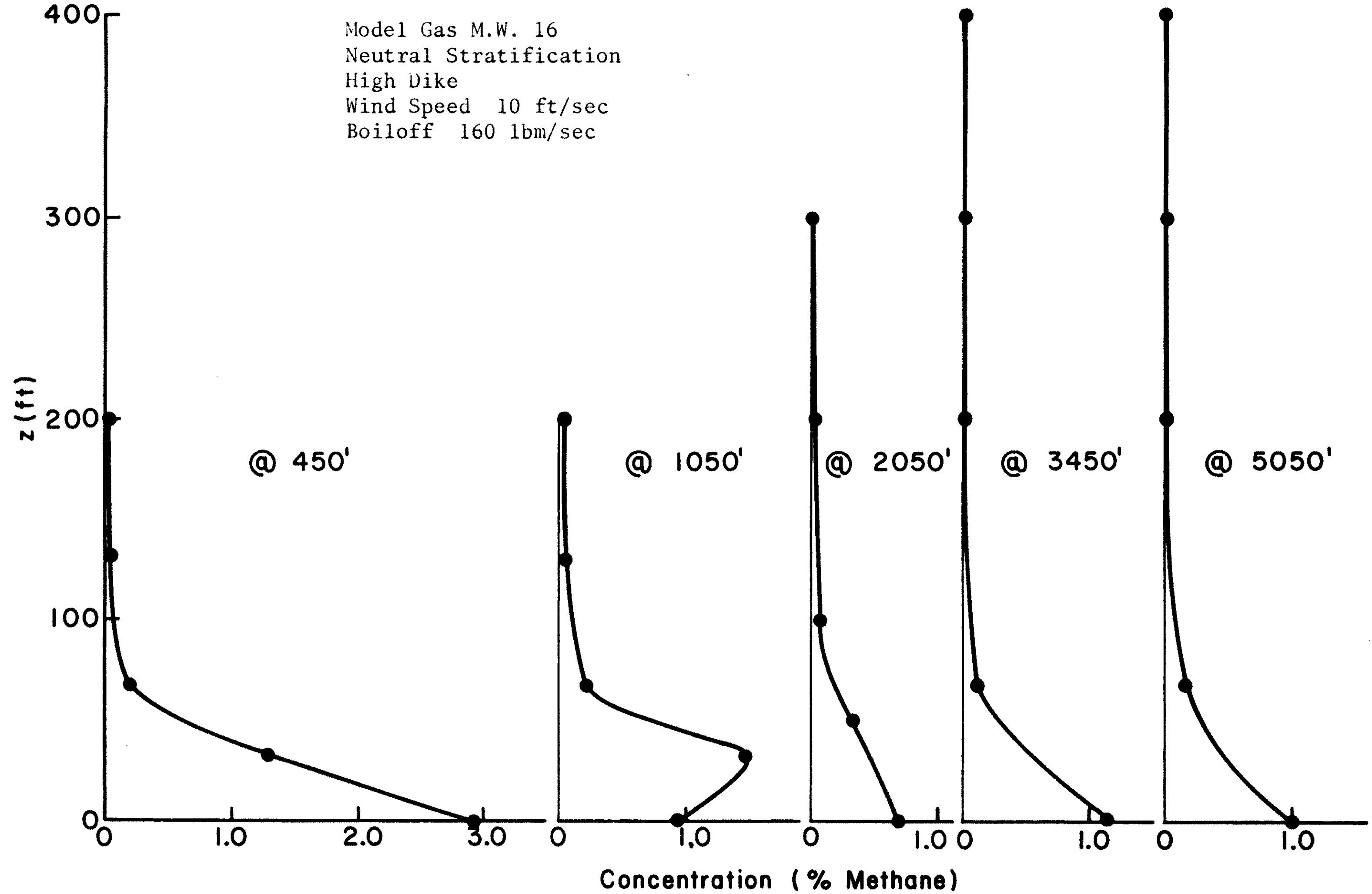


Figure 24-D Vertical Concentration Profiles at Different Distances from Release

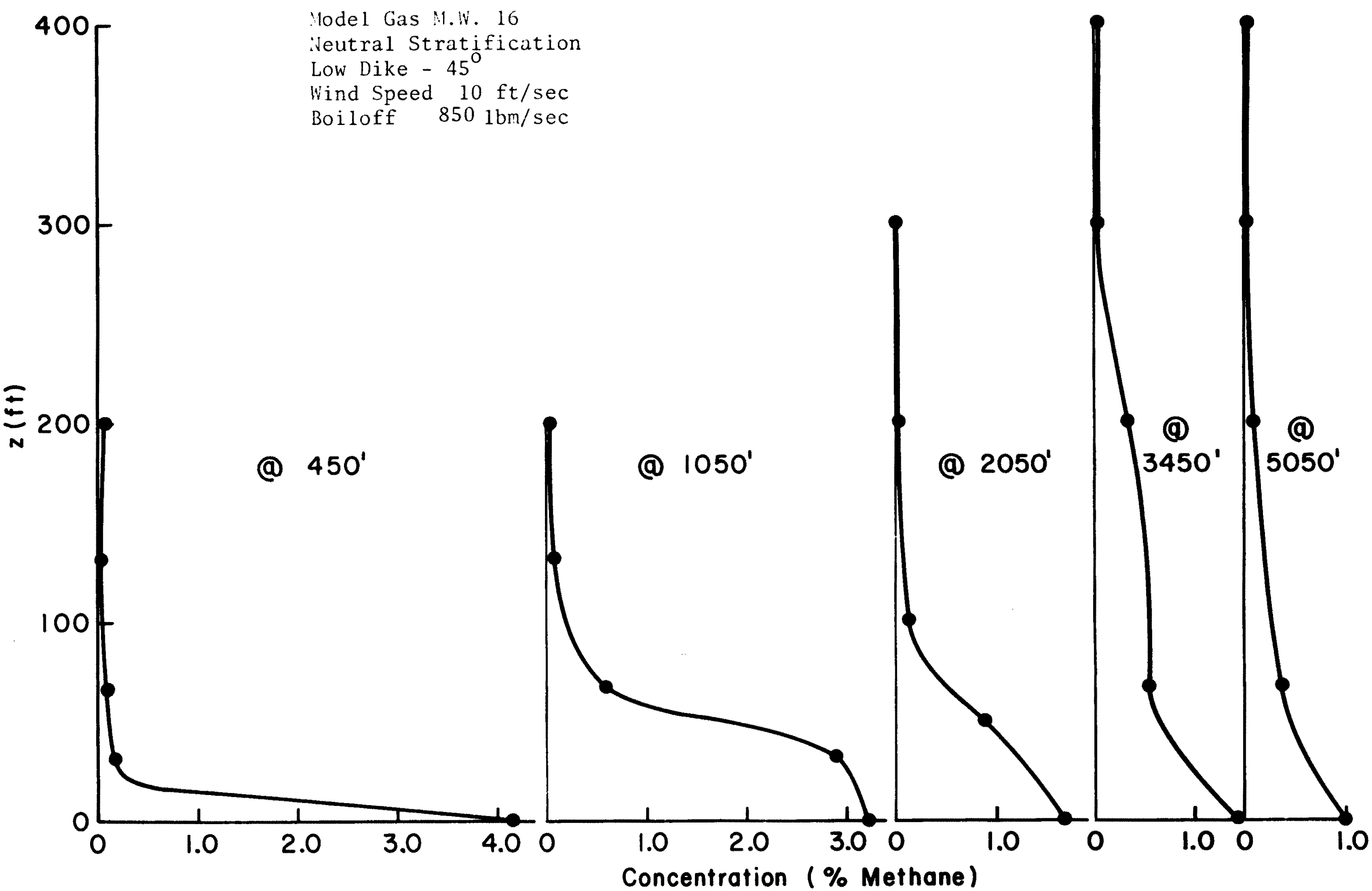


Figure 24-E Vertical Concentration Profiles at Different Distances from Release

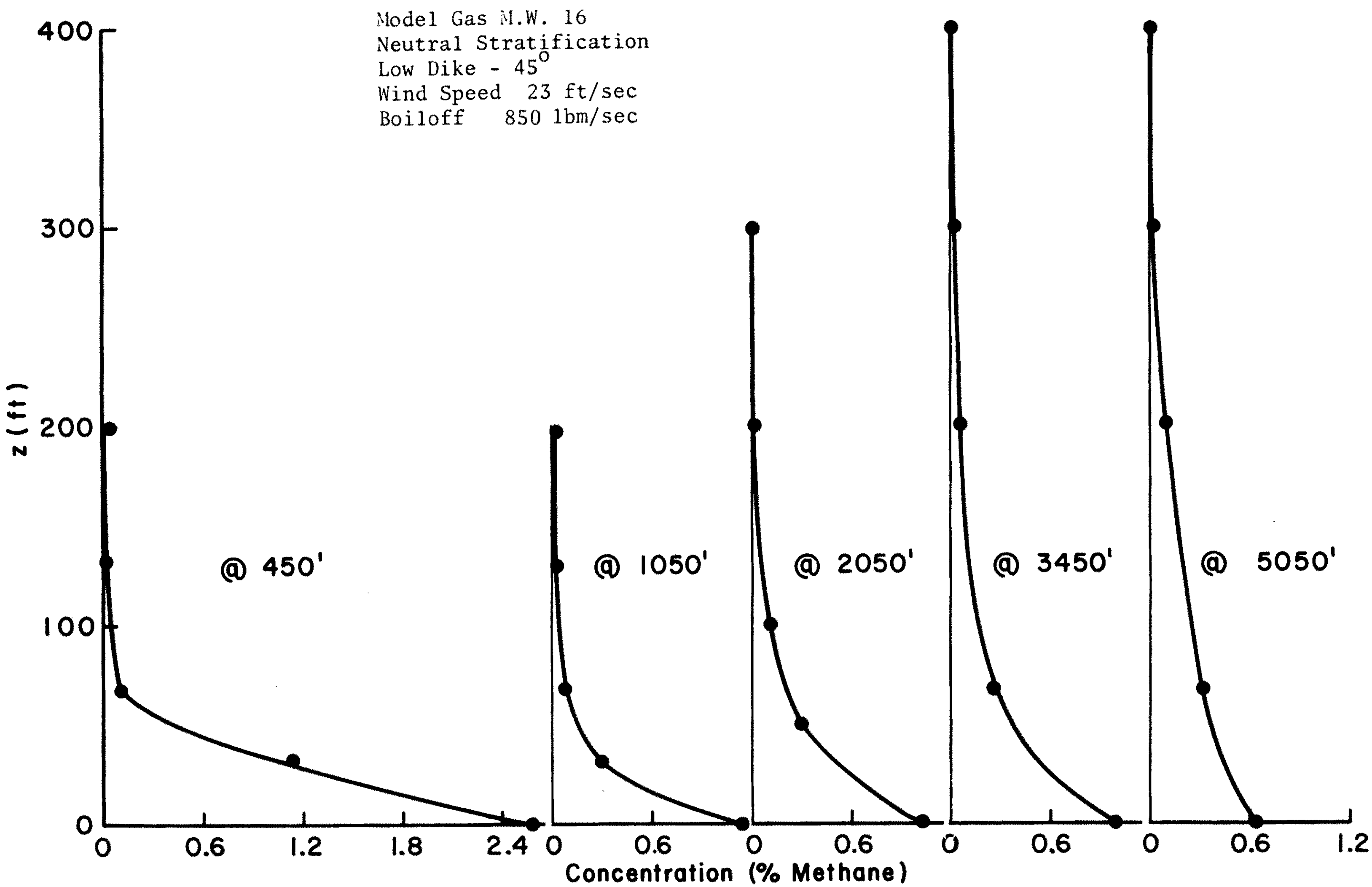


Figure 24-F Vertical Concentration Profiles at Different Distances from Release

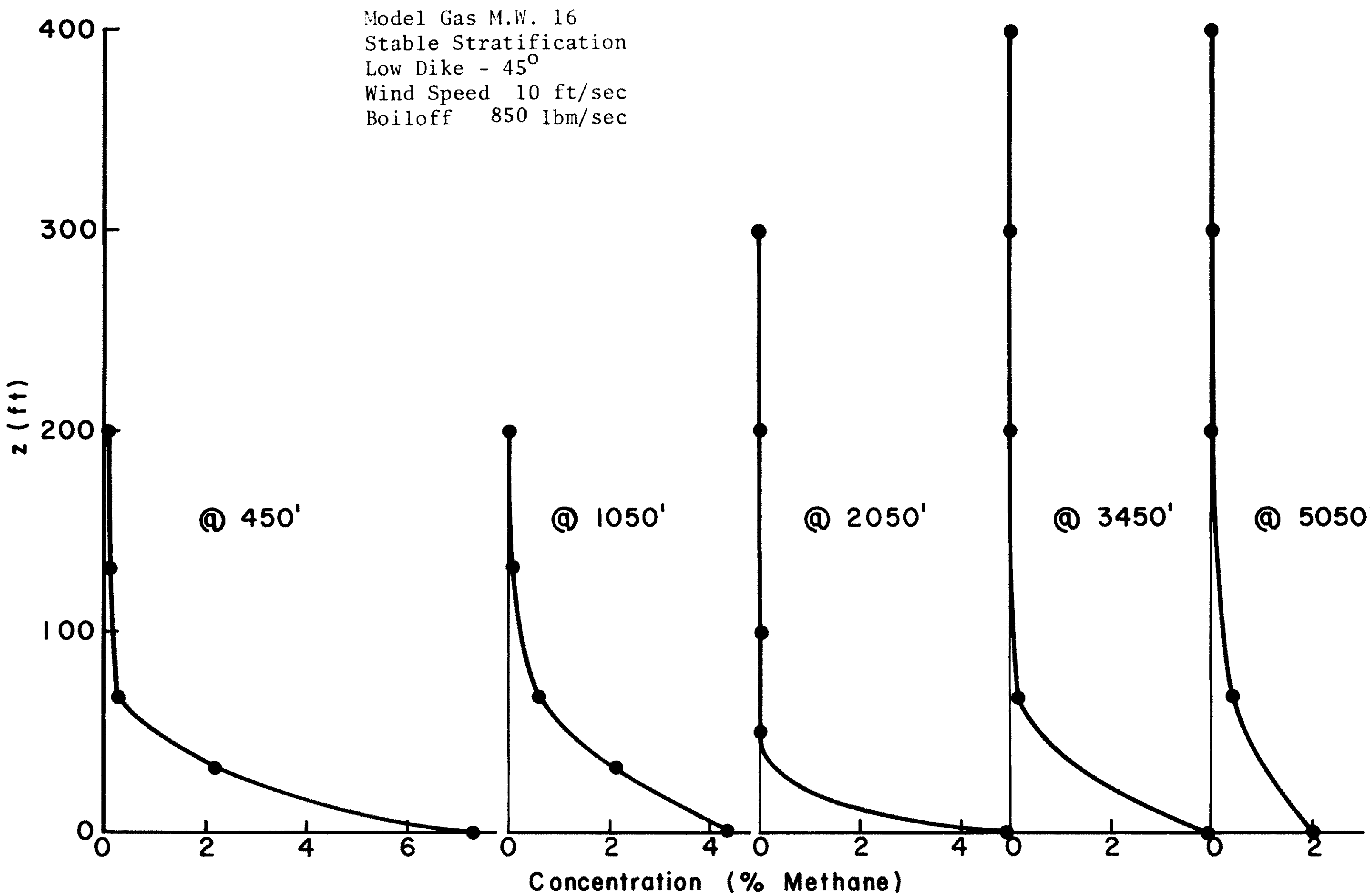


Figure 24-G Vertical Concentration Profiles at Different Distances from Release

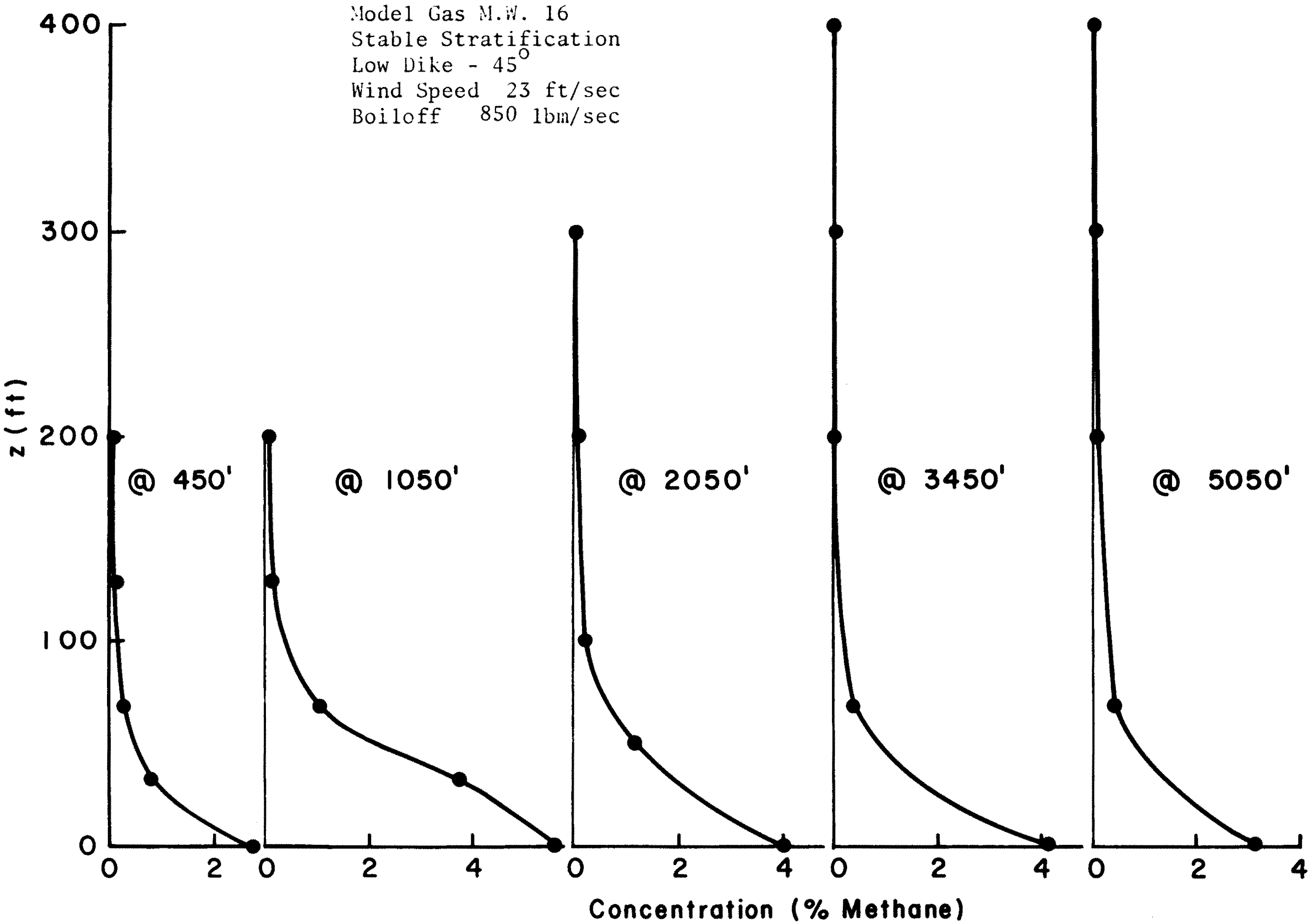


Figure 24-H Vertical Concentration Profiles at Different Distances from Release

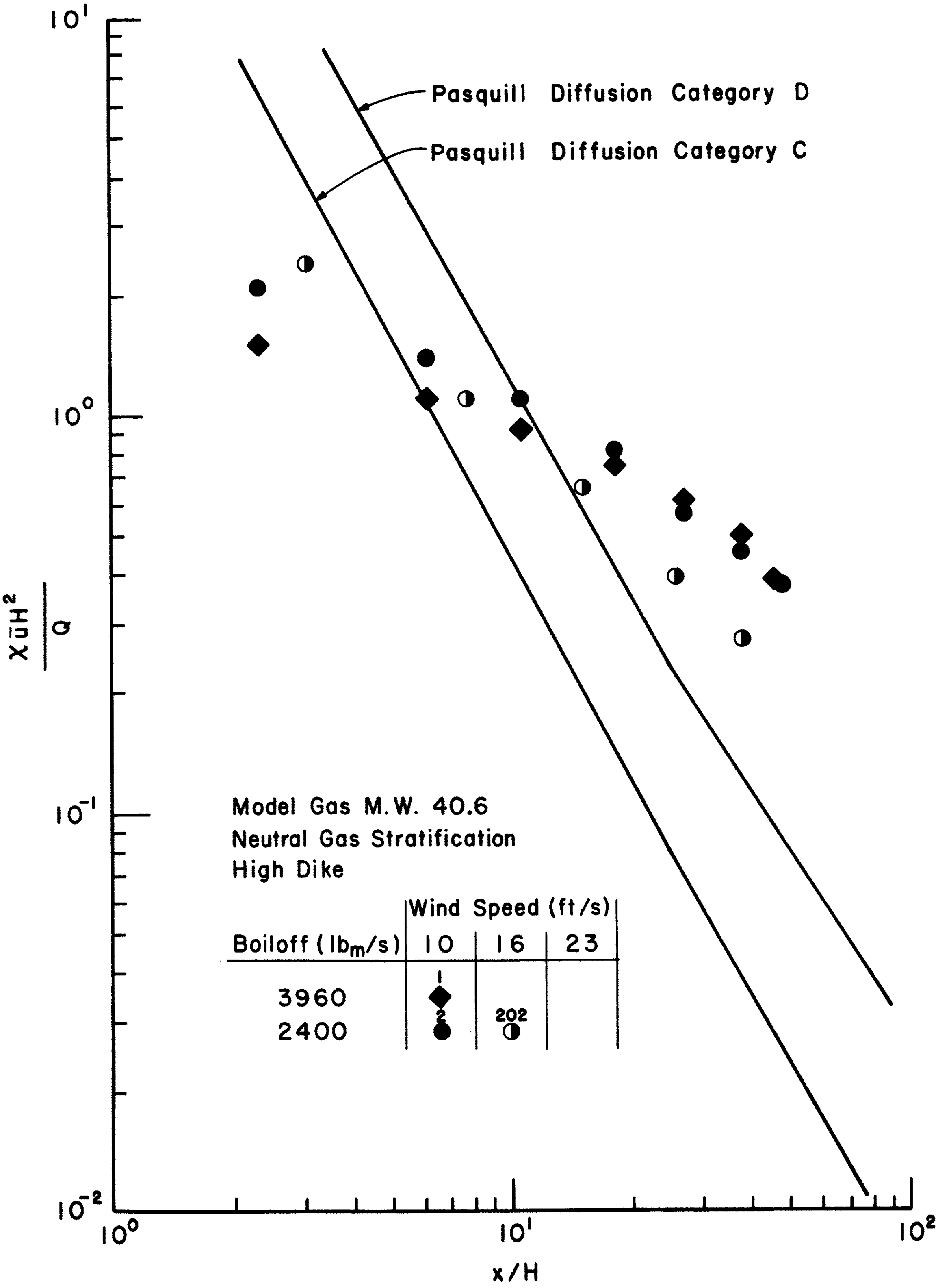


Figure 25-1 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

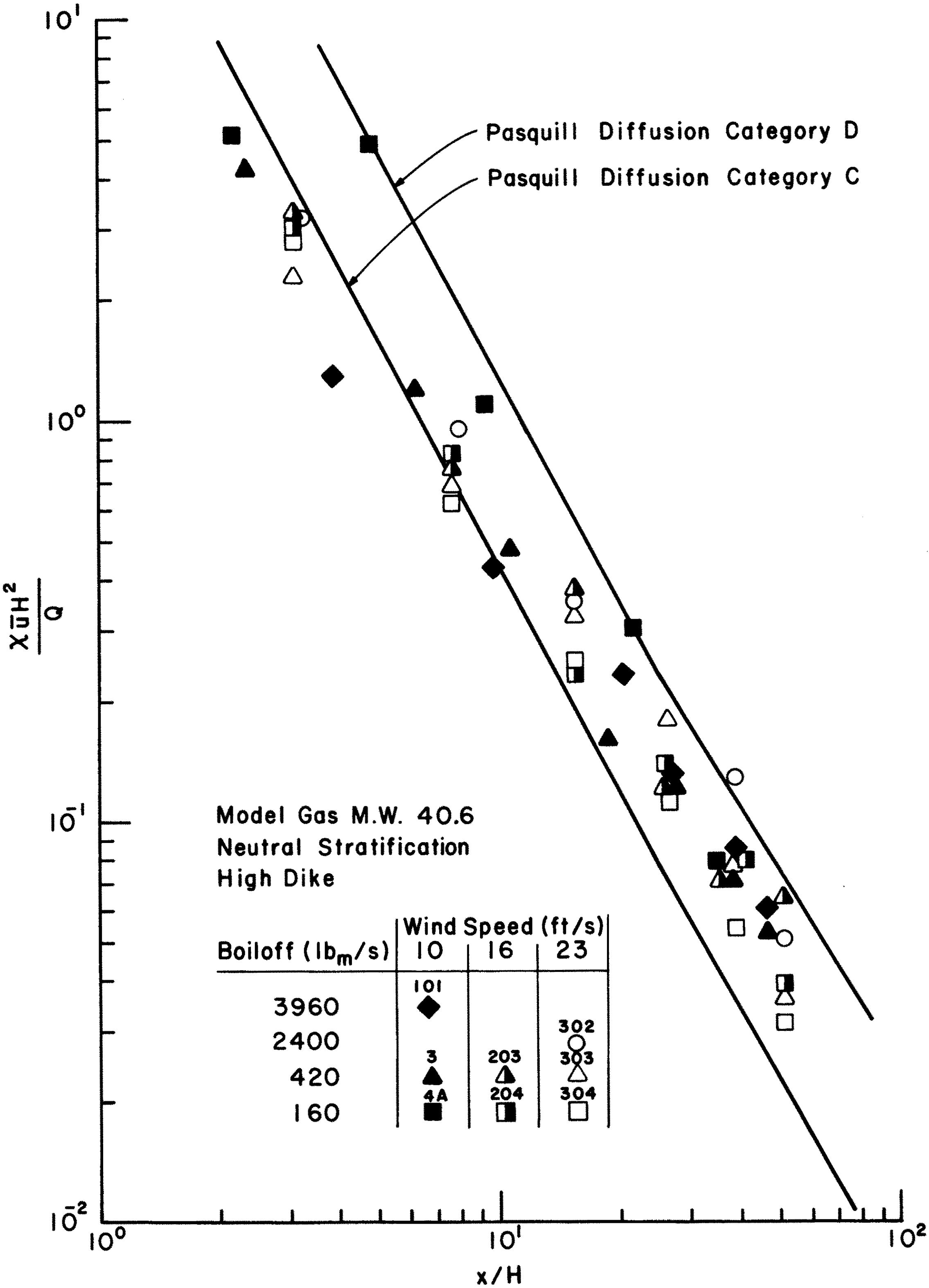


Figure 25-2 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

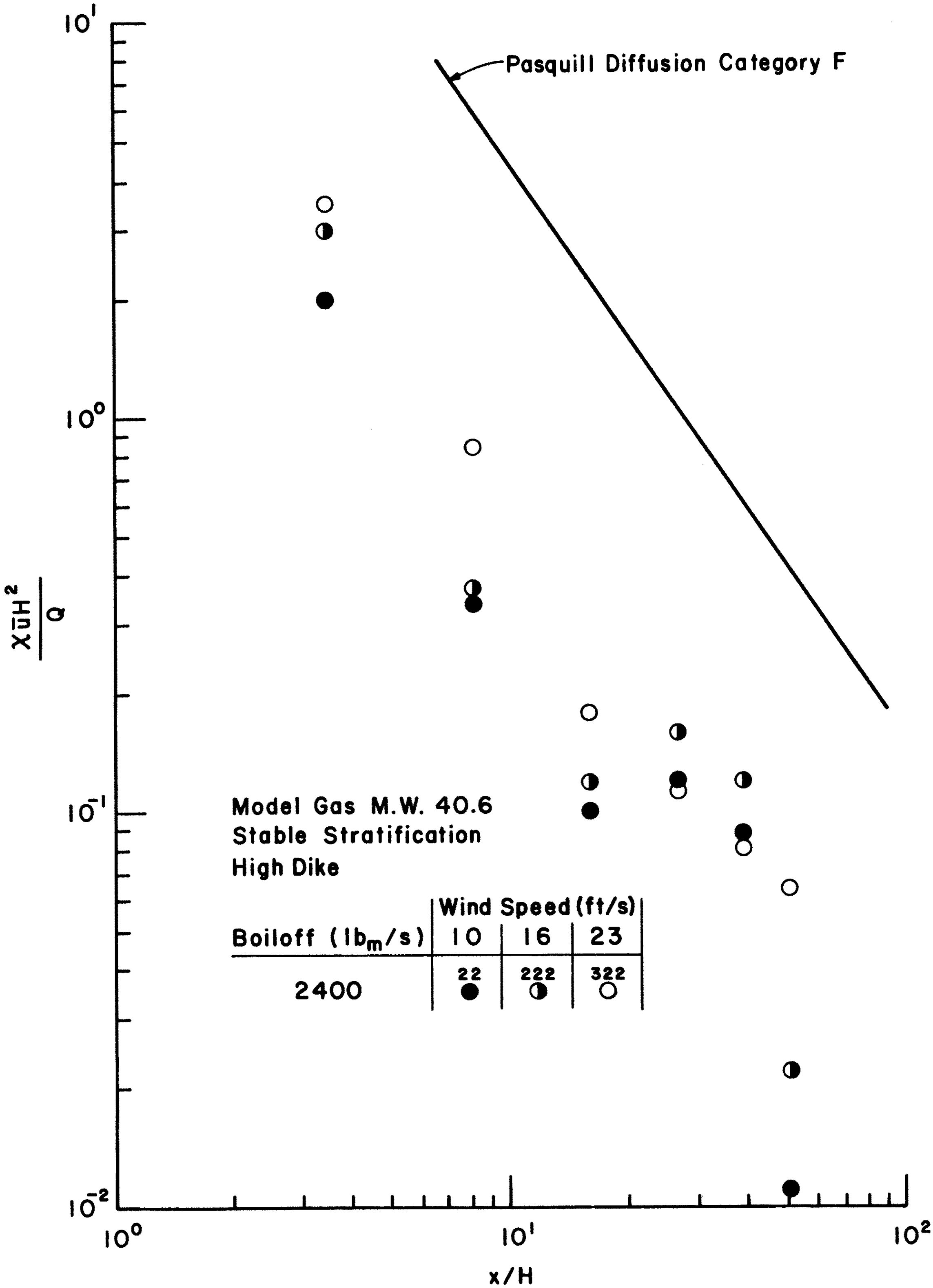


Figure 25-3 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

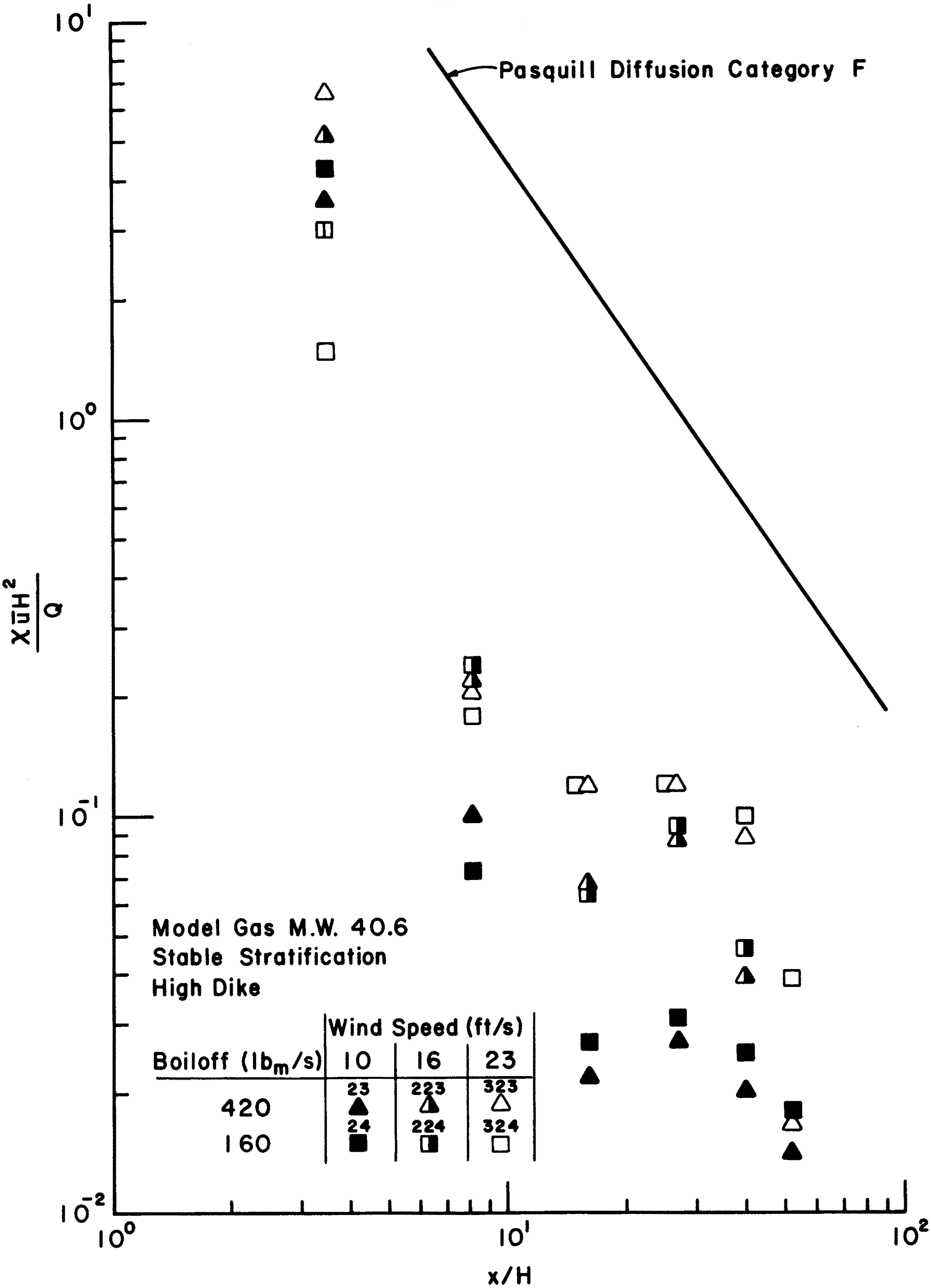


Figure 25-4 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

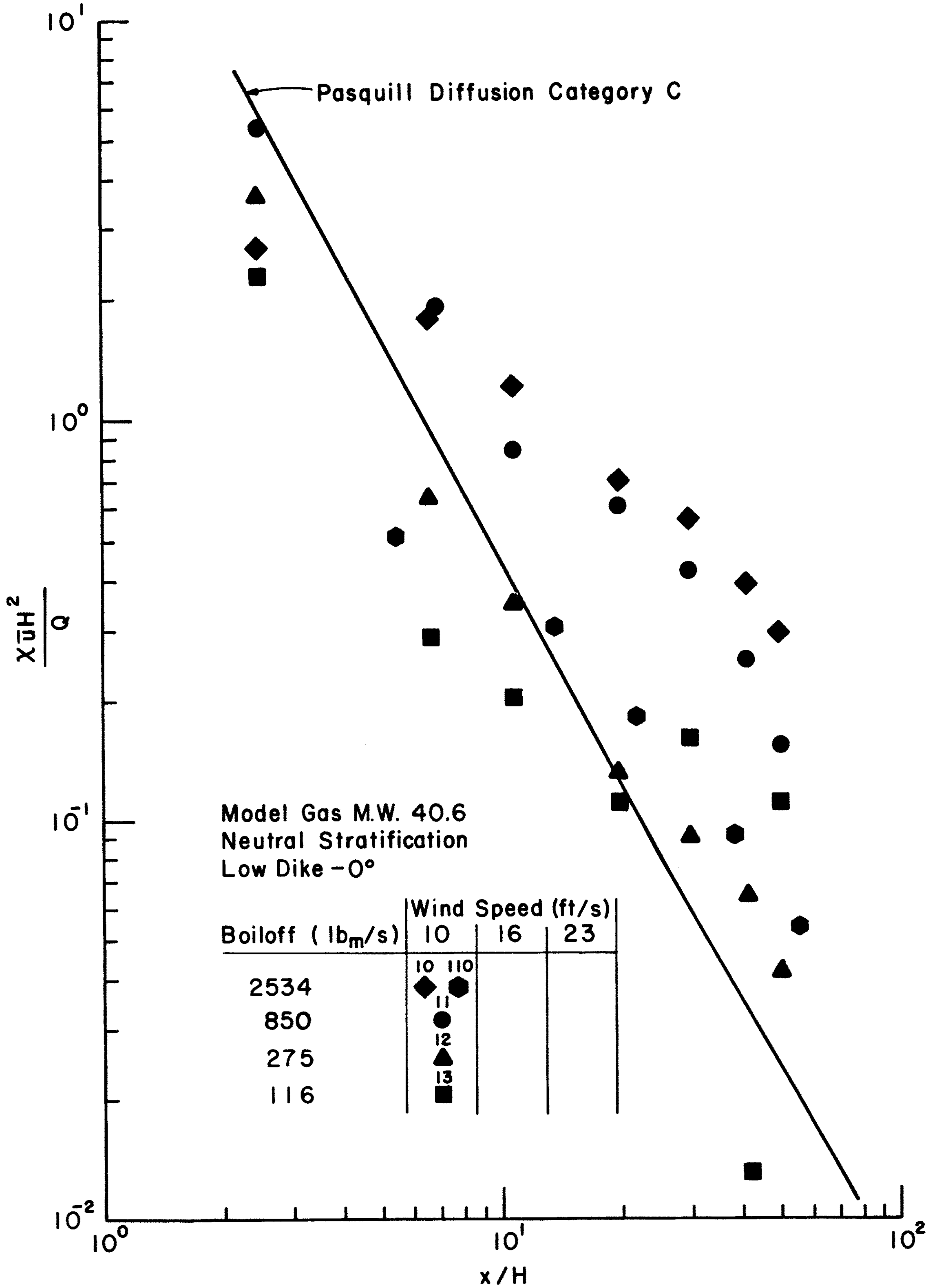


Figure 25-5 Dimensionless Concentration Coefficient vs Non-Dimensional Downwind Distance

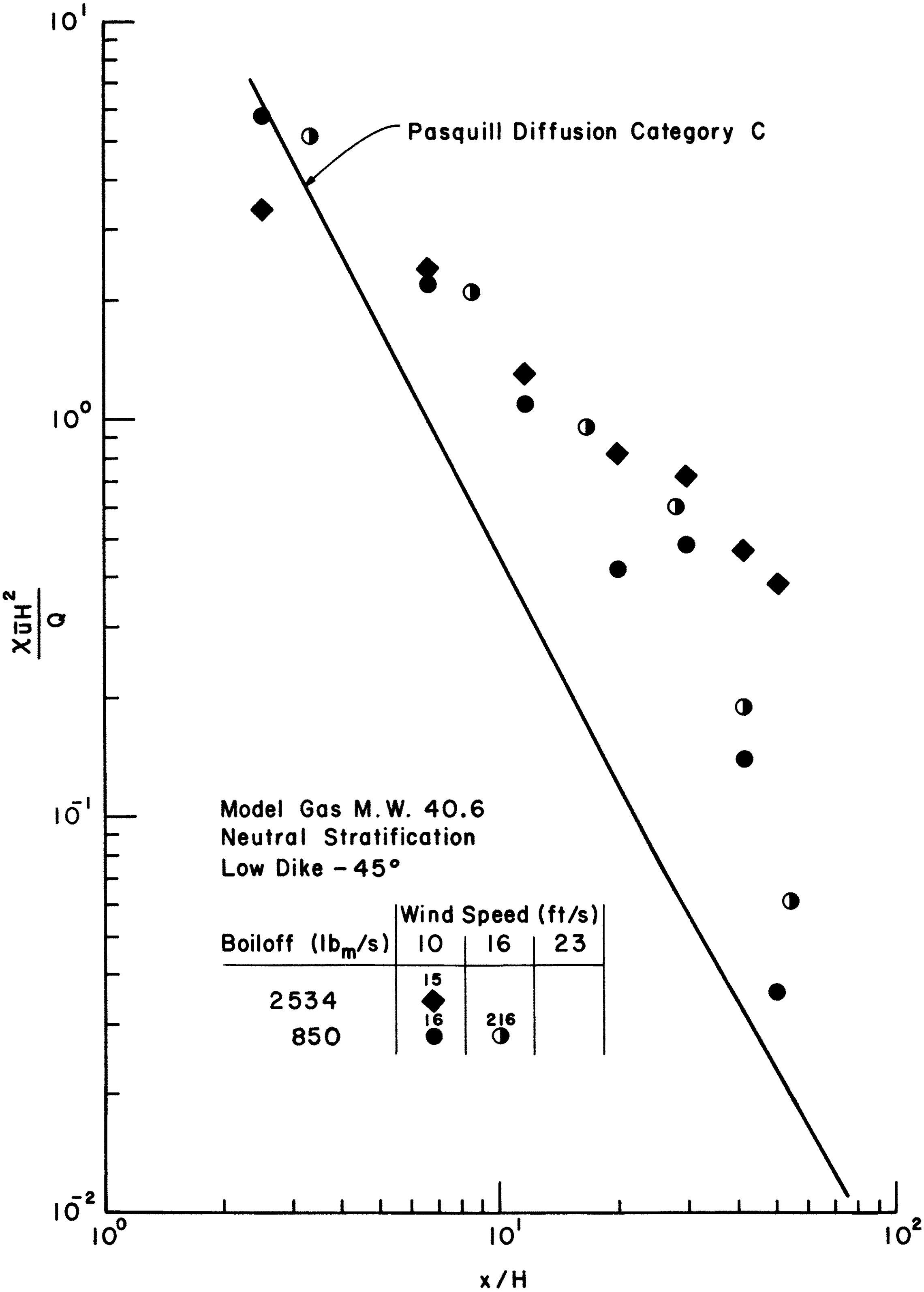


Figure 25-6 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

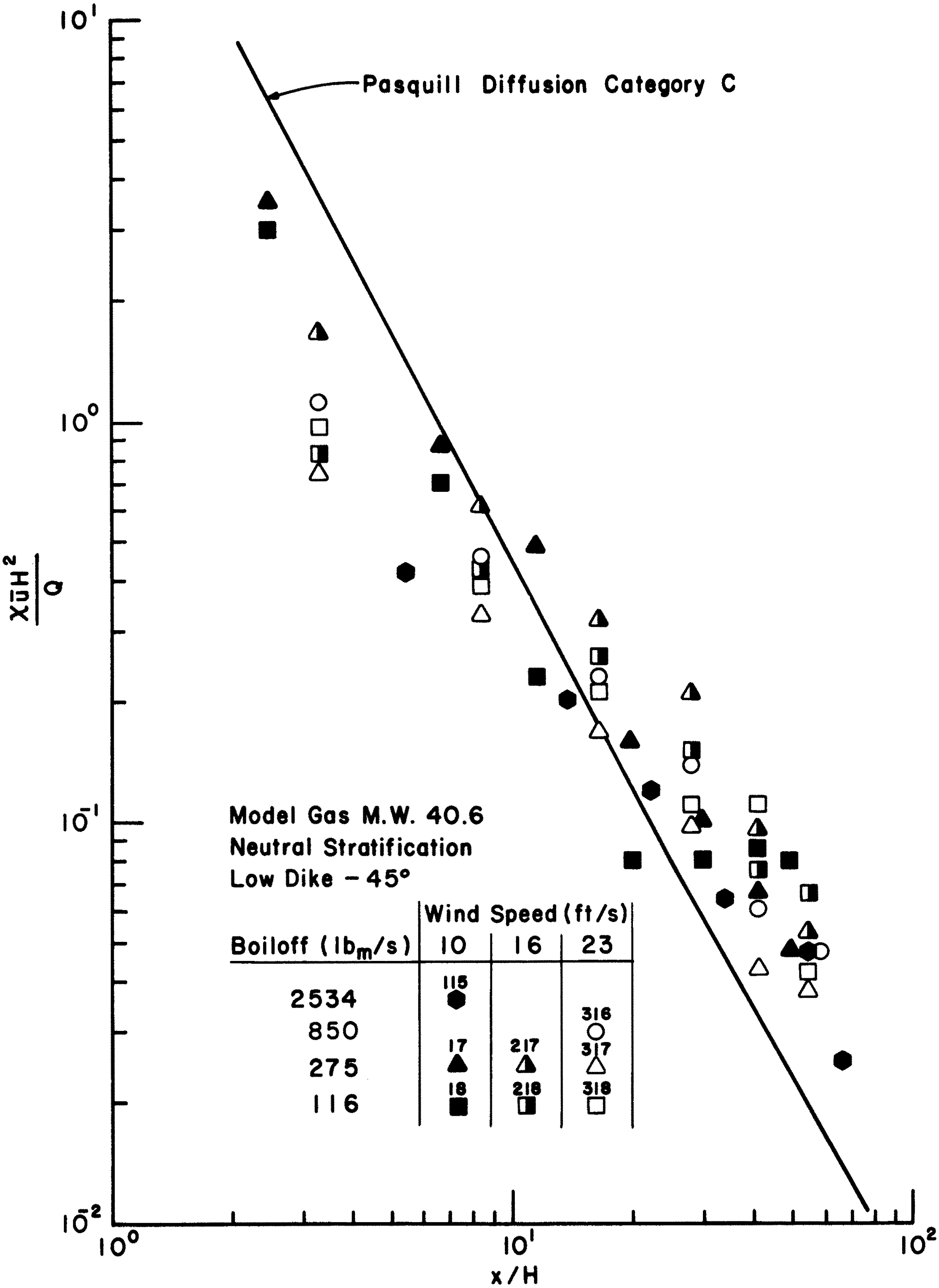


Figure 25-7 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

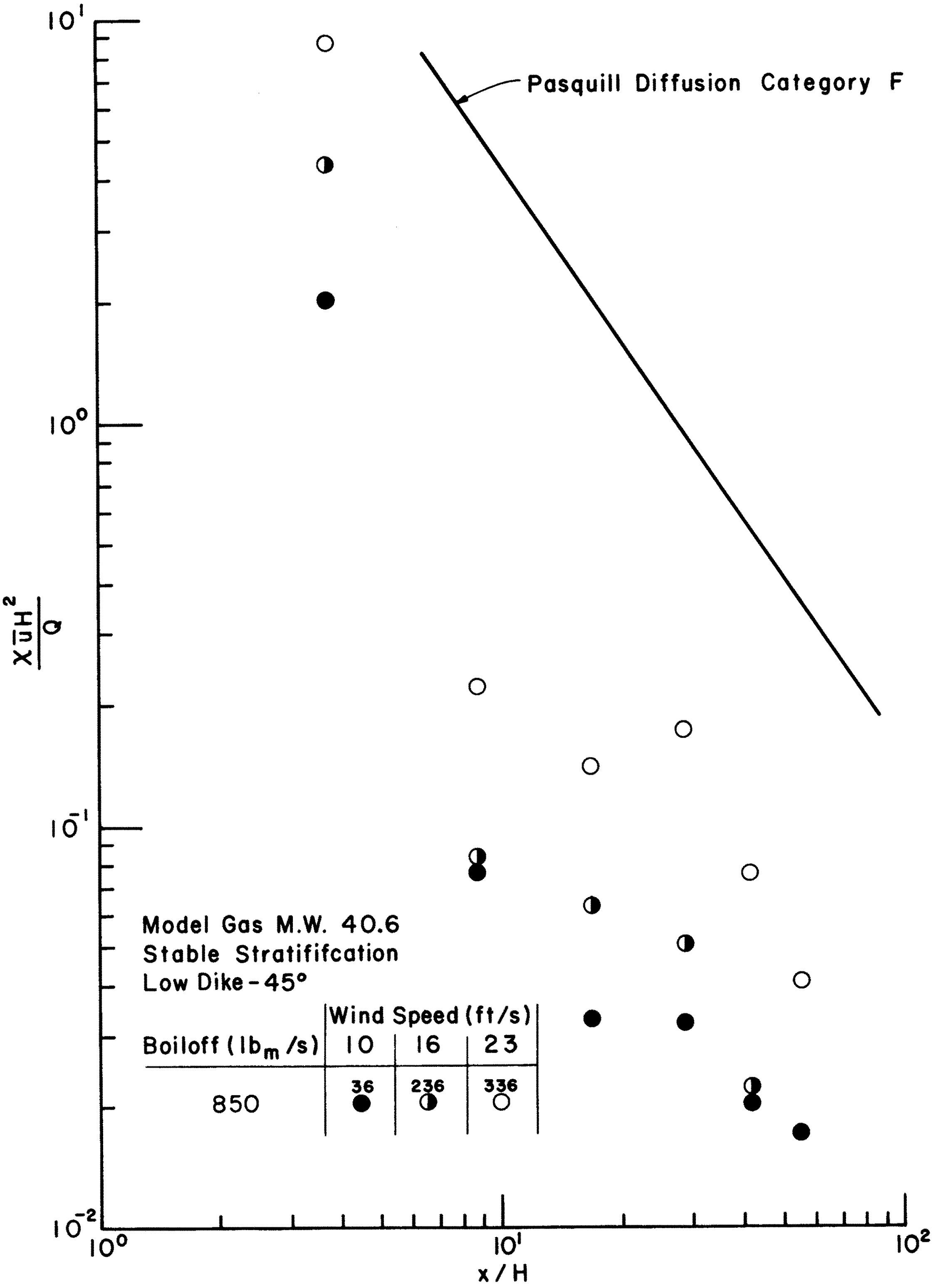


Figure 25-8 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

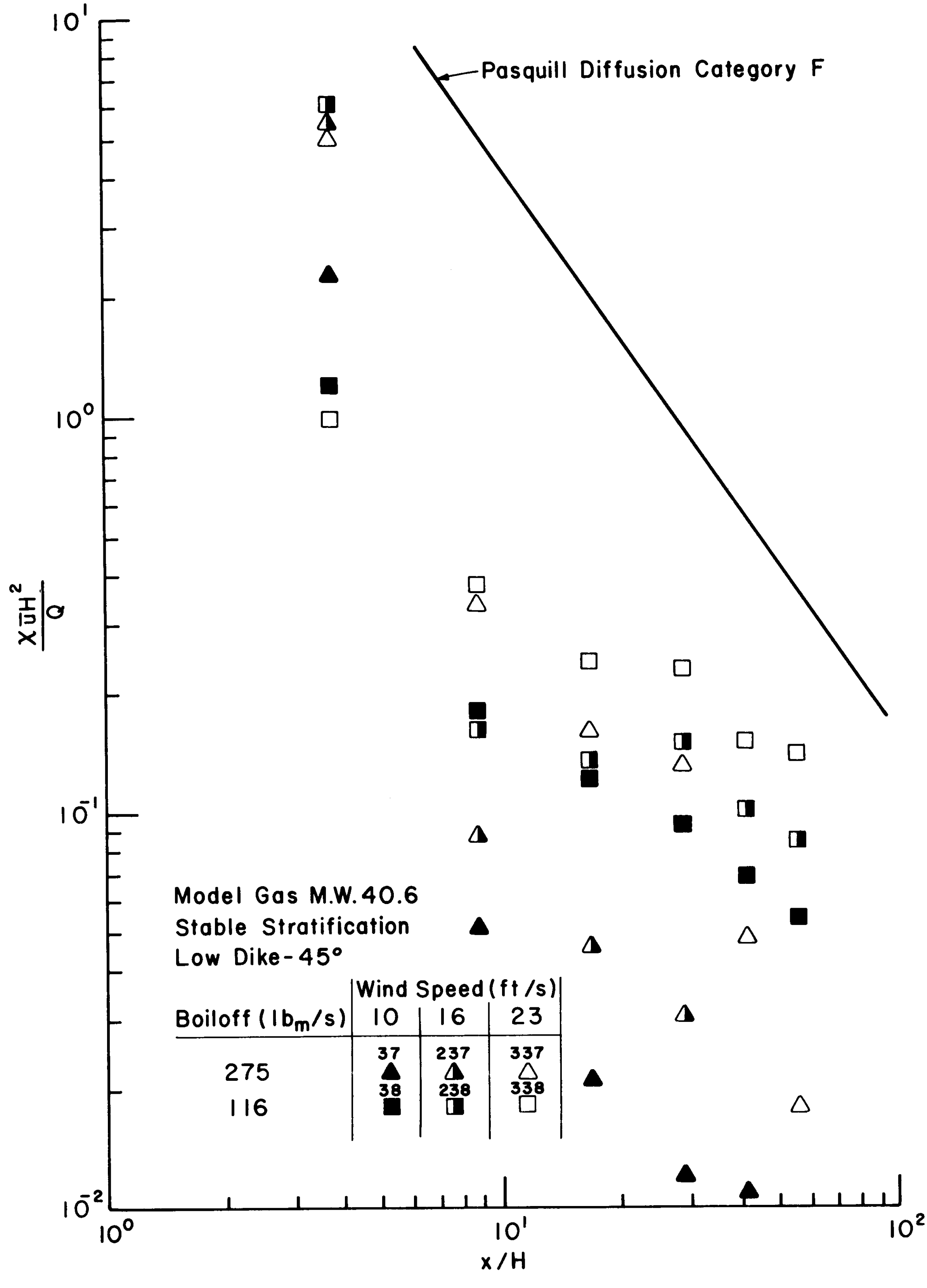


Figure 25-9 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

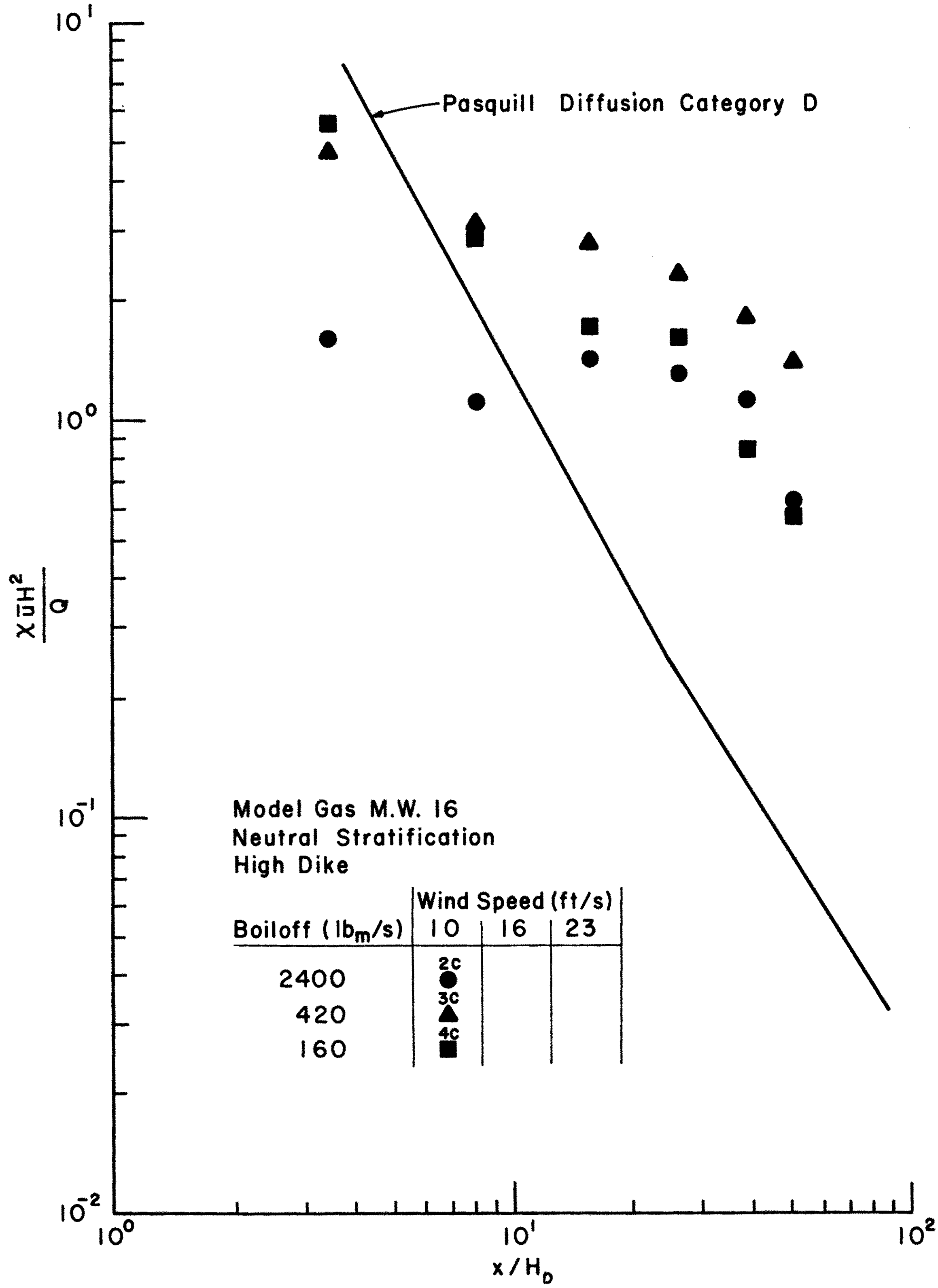


Figure 25-A Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

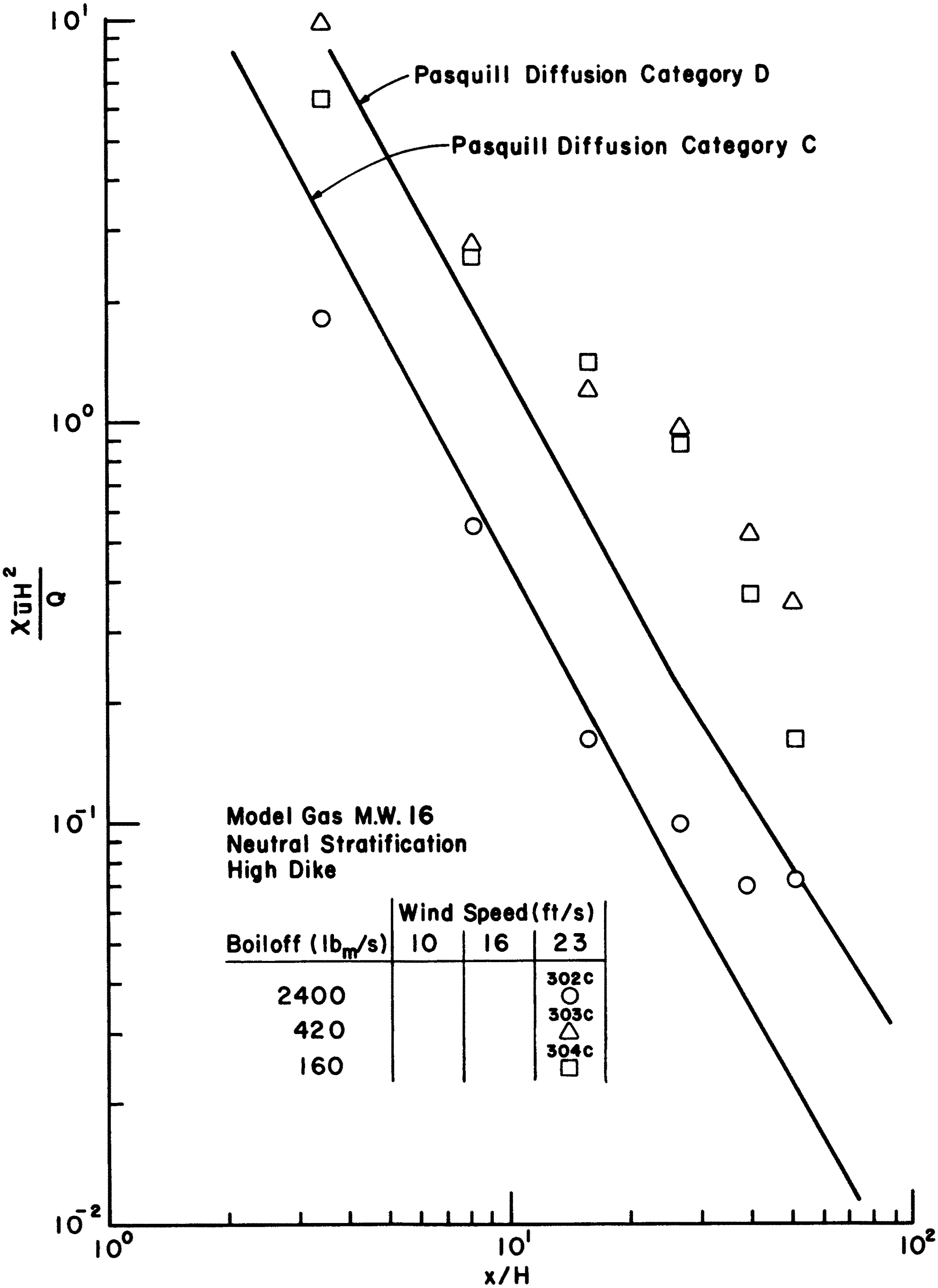


Figure 25-B Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

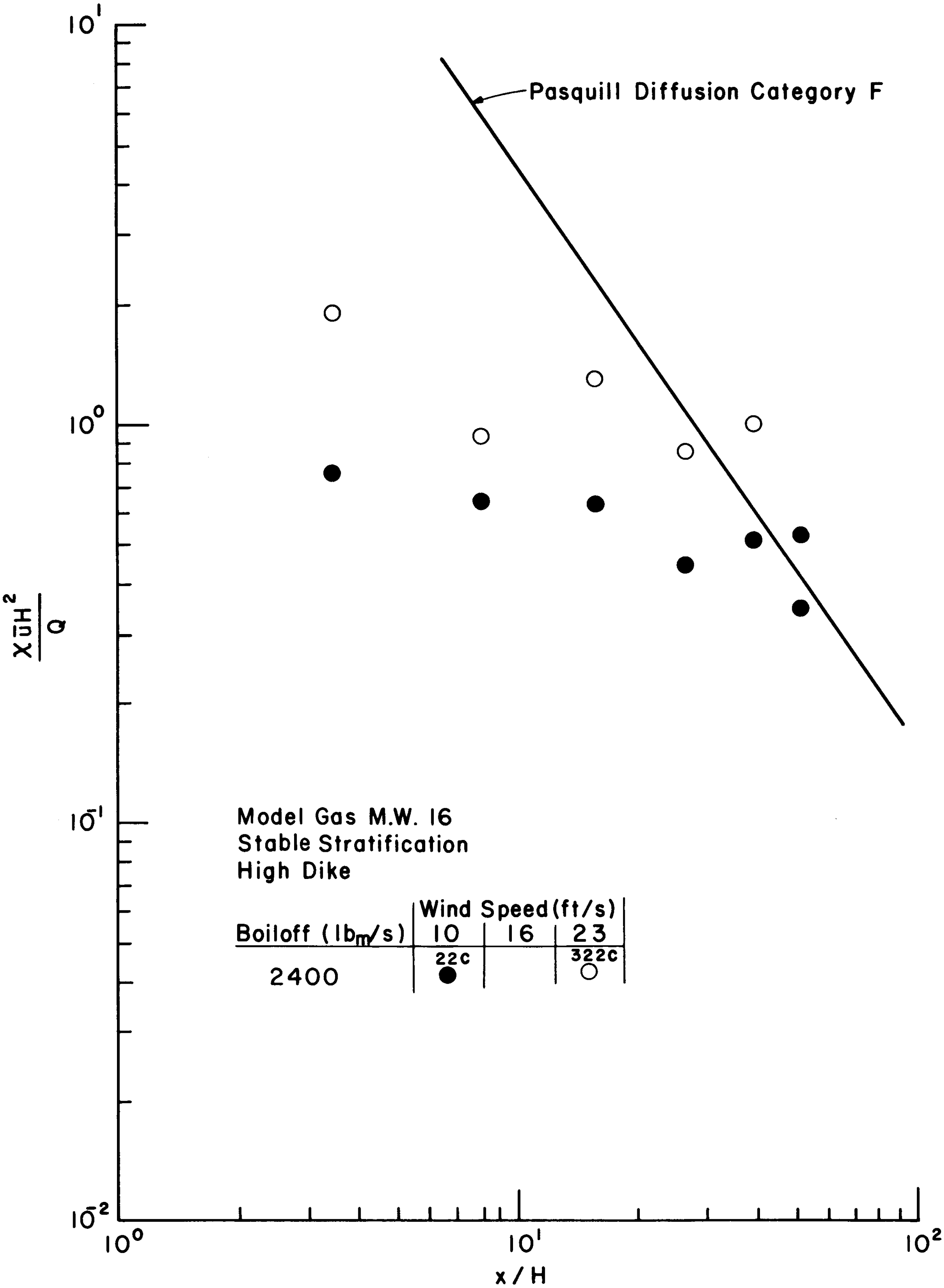


Figure 25-C Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

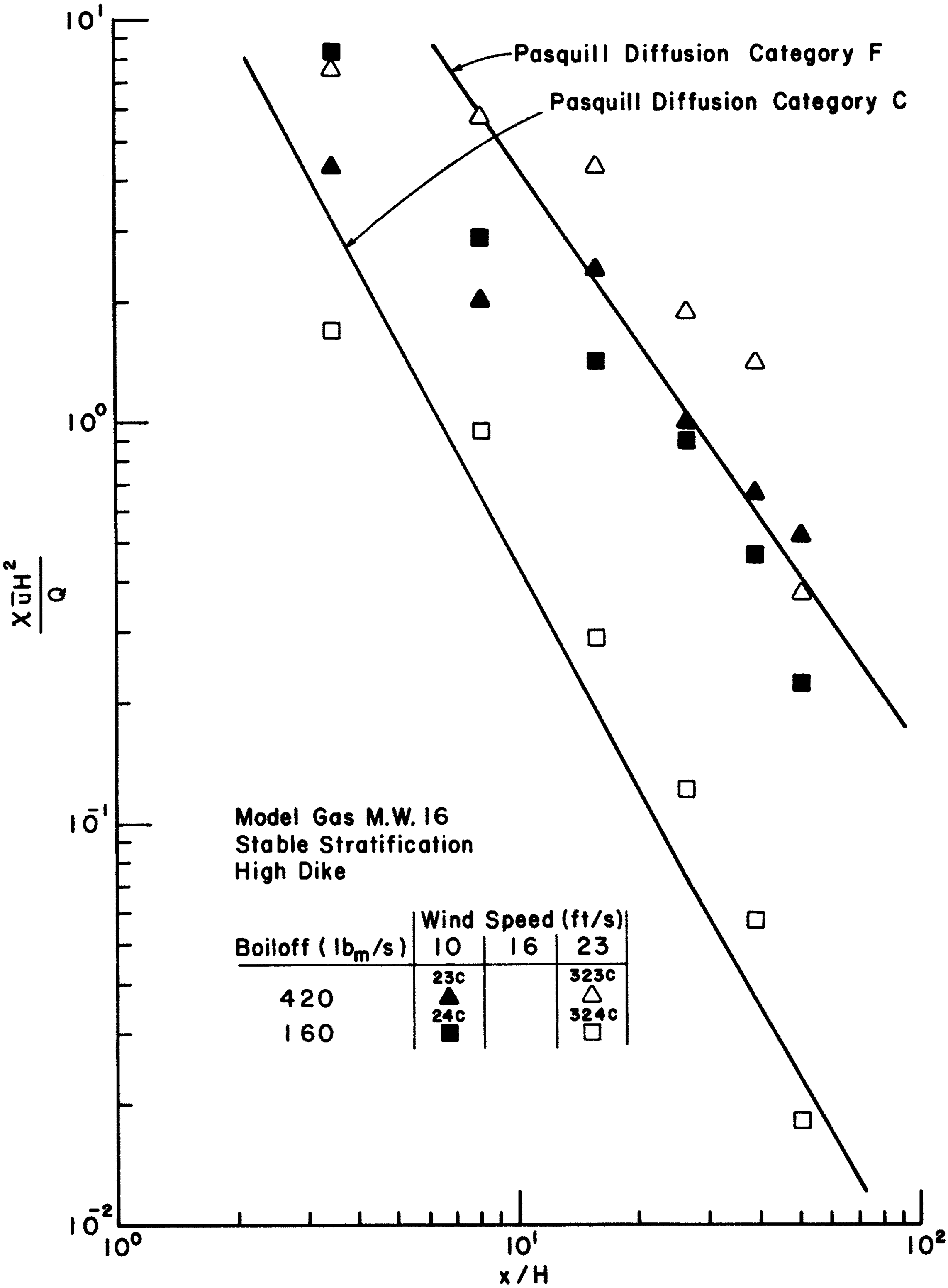


Figure 25-D Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

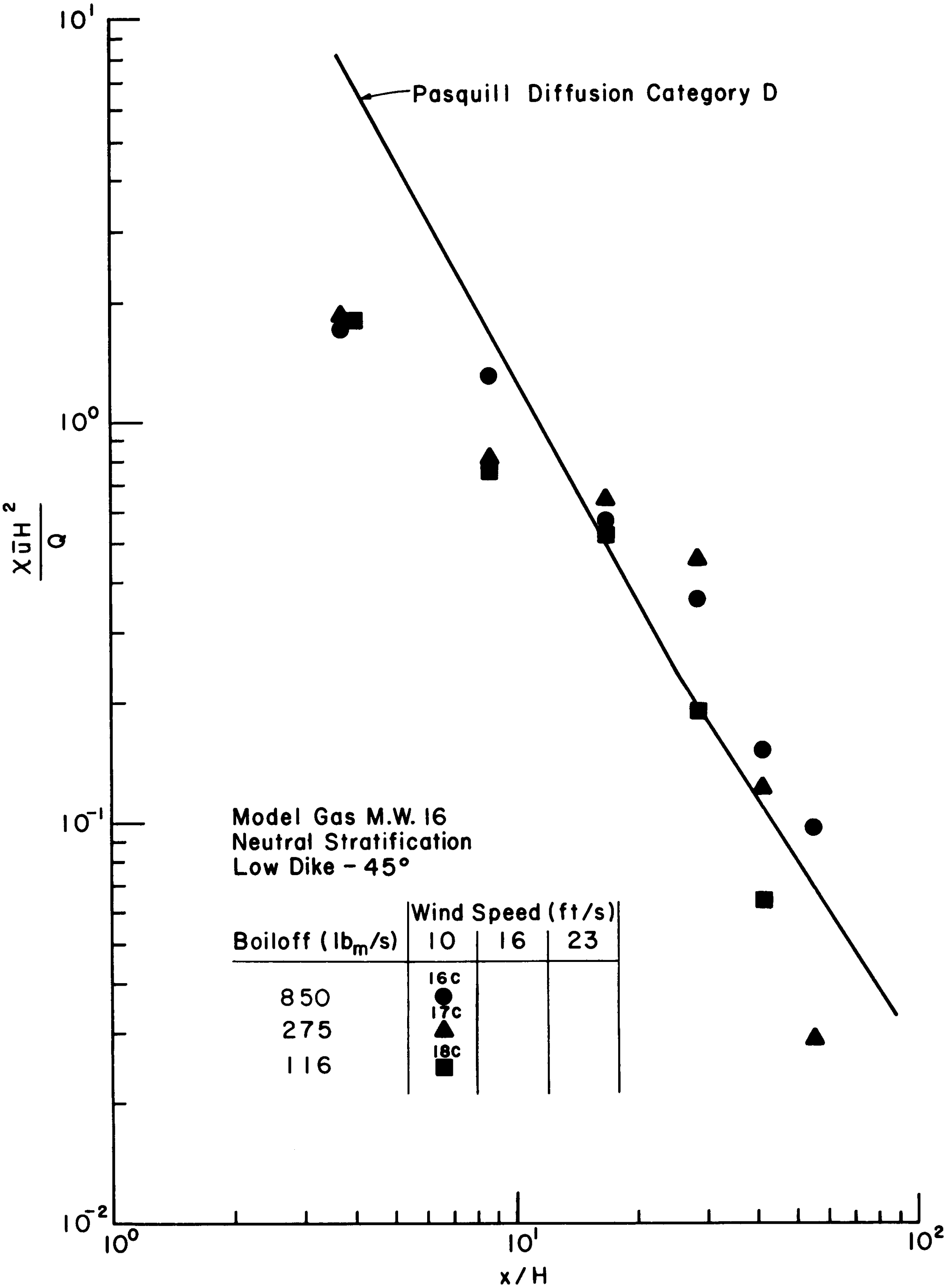


Figure 25-E Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

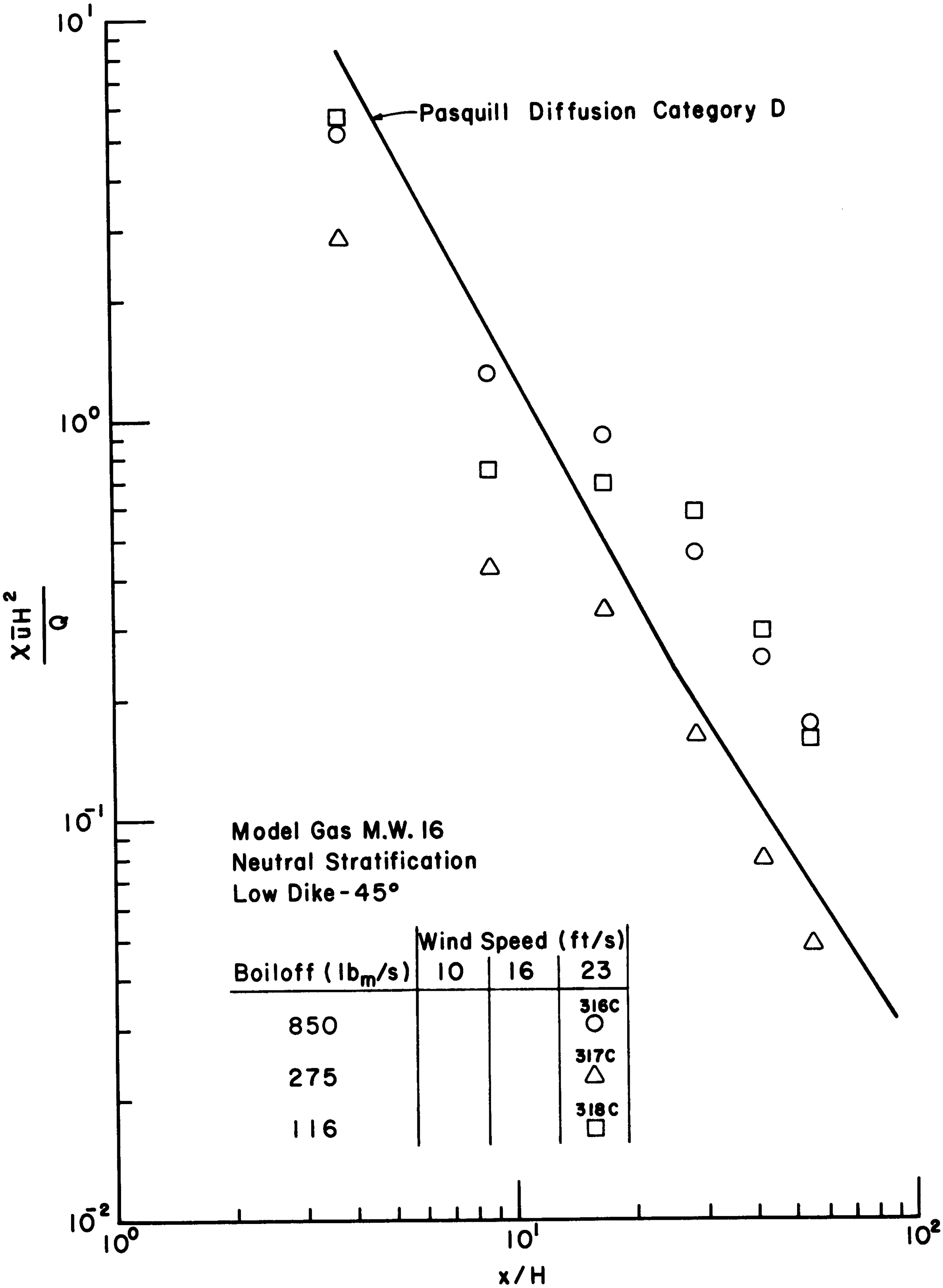


Figure 25-F Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

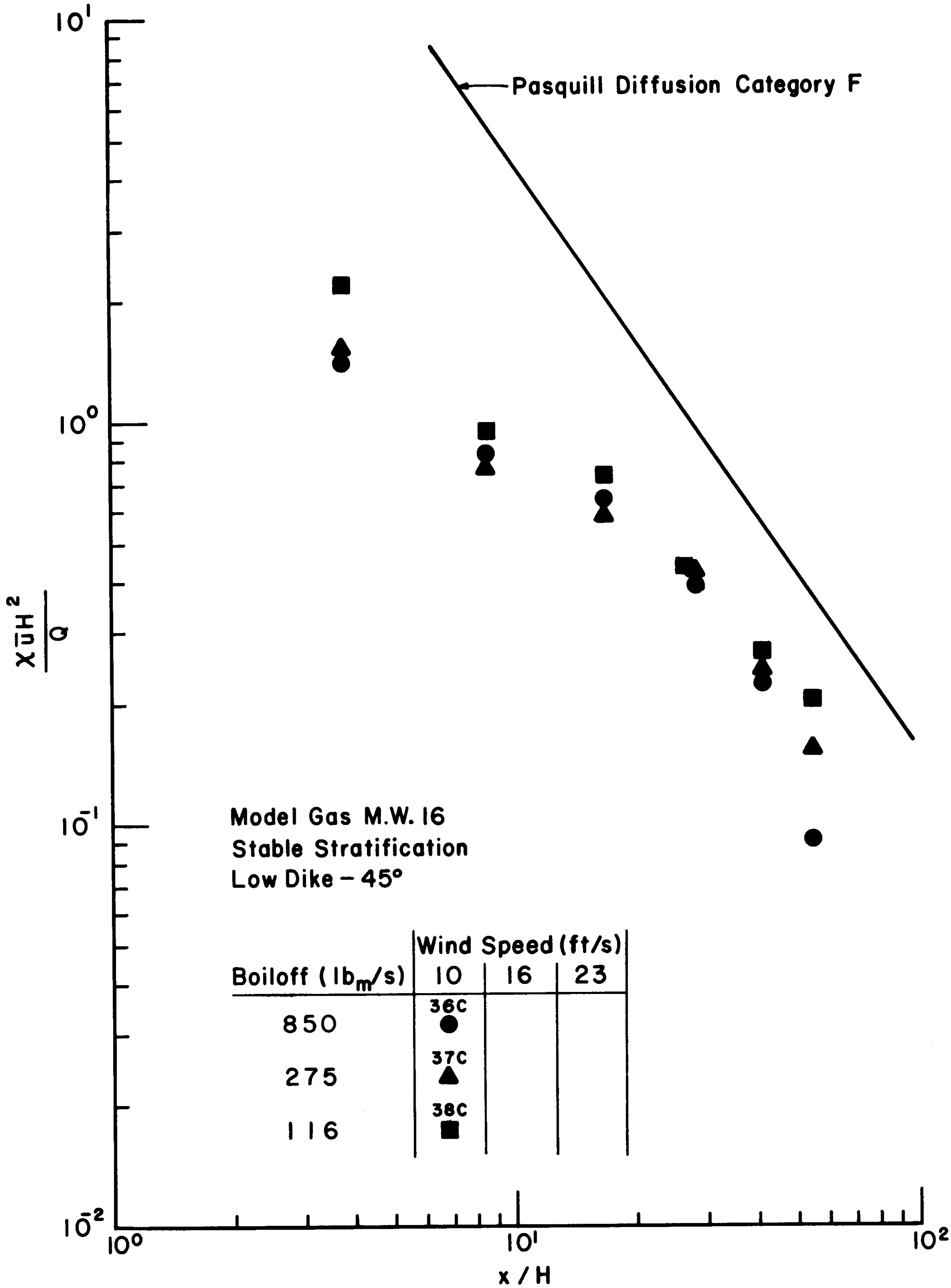


Figure 25-G Dimensionless Concentration Coefficient vs. Non-Dimensionless Downwind Distance

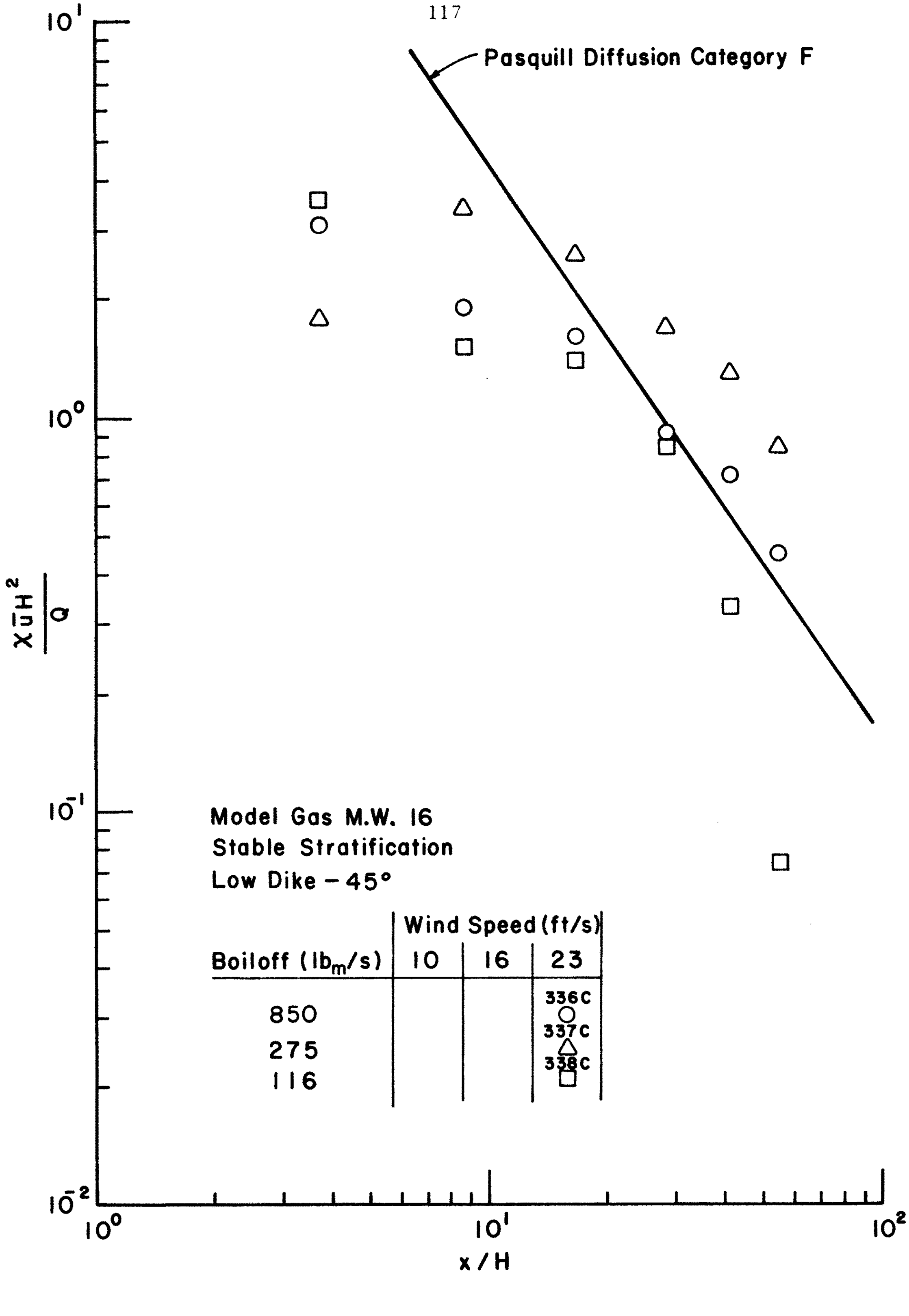


Figure 25-H Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance

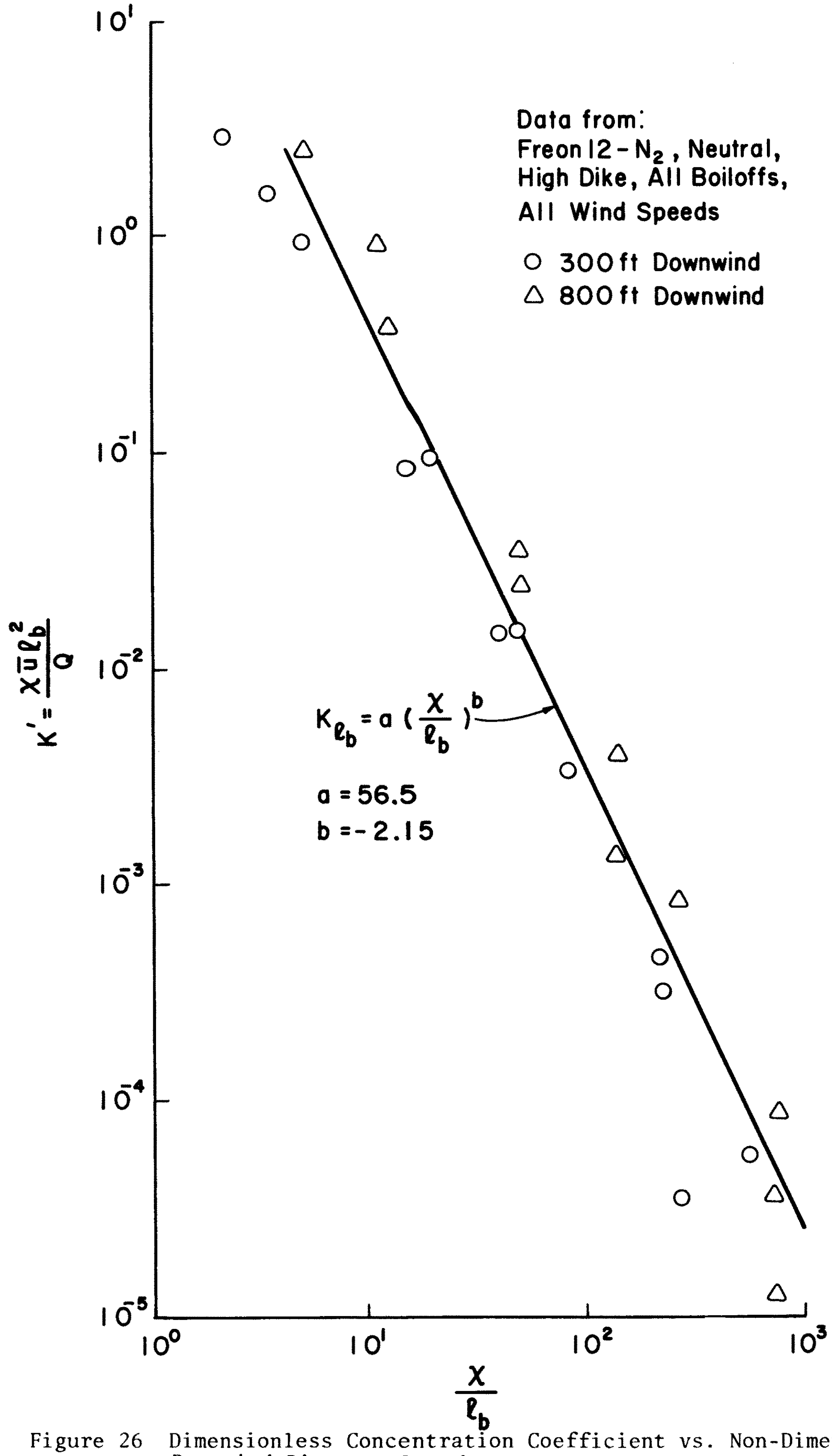


Figure 26 Dimensionless Concentration Coefficient vs. Non-Dimensional Downwind Distance Based on a Buoyancy Length Scale for High Dike, Neutral Stratification, for Freon 12-N_2 Simulation Gas

Table 1. Prototype Conditions

Characteristic		Full Scale: High Dike	Full Scale: Low Dike
Tank Diameter D	(ft)	240	128
Height H	(ft)	129	121
Dike Diameter d	(ft)	260	330 x 305
Height h	(ft)	80	21
Boiloff Rates m_{mx}	$\frac{lbm}{sec}$	3955.5	3724.1
Q_{mx}	cfm	2.27×10^6	2.13×10^6
m_{min}	$\frac{lbm}{sec}$	100.0	231.6
Q_{min}	cfm	5.59×10^4	1.33×10^5
Velocity U_H	$\frac{ft}{sec}$	10, 16, 23	10, 16, 23
ΔT	^oF	18-24	18-24
$S.G._{CH_4}$ @ boiloff		1.4	1.4
$\Delta\rho/\rho_a$		.4	.4
$Re_D = U_H D/\nu$		1.43×10^7, 2.29×10^7, 3.29×10^7	7.62×10^6, 1.22×10^7, 1.75×10^7
$Fr_d = \dfrac{U_H^2}{g \frac{\Delta\rho}{\rho_a} d}$		.030, .076, .16	.022, .056, .12
$Ri_{B_p} = Ri_{B_m}$		3.2-0.7	3.2-0.7
Times	sec	1, 200, 1000	1, 200, 1000

$T_B = 201^oR$, $\rho_L = 26.5$ lbm/ft^3, $\rho_{gB} = .1047$ lbm/ft^3, $\nu = 1.68 \times 10^{-4}$ ft^2/sec

Table 2. Model Conditions

Characteristic		Full-scale 1/200 model: High Dike	Full-scale 1/200 model: Low Dike	High Dike 1/500	Low Dike 1/666
Tank Diameter D	(in)	14.4	7.68	5.53	2.33
Height H	(in)	7.74	7.26	2.98	2.20
Dike Diameter d	(in)	15.6	19.8 x 18.3	6.0	6.0 x 5.54
Height h	(in)	4.8	1.26	1.85	.38
$Fr_m = Fr_p$		0.03, 0.076, 0.16	0.022, 0.0563, 0.116	0.03	0.03
$S.G._{CH_4}$ @ boiloff		1.4	1.4	1.4	1.4
$(\Delta\rho/\rho_a)_m = (\frac{\Delta\rho}{\rho_a})_p$		0.4	0.4	0.4	0.4
U_H^*	ft/sec	0.7, 1.15, 1.6	0.7, 1.15, 1.6	0.45	0.40
$Re_{D_m} = U_H D/\nu$		5071, 8286, 11571	2704, 4419, 6171	1234	451
$Ri_{B_m} = \frac{(T_H - T_{.14H})(H - .14H)g}{\overline{T}(U_H - U_{.14H})^2}$		3.2-0.7	3.2-0.7	0	0
ΔT^{Δ}	^oF	18-24	18-24	0	0
Boiloff$^{\blacksquare}$ Rates U_{mx}	ft/sec	0.34	0.025	0.15	0.035
Q_{mx}	cfm	4.01	3.77	0.41	0.19
U_{min}	ft/sec	0.009	0.0016	0.002	0.002
Q_{min}	cfm	0.10	0.24	0.010	0.012
Time^o	sec	0.07, 14.1, 70.7	0.07, 14.1, 70.7	0.04, 8.9, 44.7	0.04, 7.7, 38.7

$\overline{T} = (T_H - T_{.14H})/2$

$^*U_{Hm} = (\frac{1}{L.S.})^{1/2} U_{Hp}$ $\quad$ $^{\Delta}\Delta T_m = \Delta T_p (\frac{U_m}{U_p})^2 (\frac{H_{T_p}}{H_{T_m}}) = \Delta T_p \left[(\frac{1}{L.S.})^{1/2}\right]^2 L.S. = \Delta T_p$

$^o t_m = (\frac{U_{\infty p}}{U_{\infty m}})(\frac{L_m}{L_p}) = (L.S.)^{1/2} \frac{1}{L.S.} t_p = (\frac{1}{L.S.})^{1/2} t_p$ $\quad$ $^{\blacksquare}Q_m = Q_p \frac{U_m}{U_p} (\frac{L_m}{L_p})^2 = Q_p (\frac{1}{L.S.})^{1/2} (\frac{1}{L.S.})^2 = Q_p (\frac{1}{L.S.})^{2.5}$

Table 3 Instrumentation and Materials Employed

Camera	Movie: Bolex 16mm camera lens Still: Speed Graphic Camera 4" x 5" and Hasselblad 2" x 3"
Film	Movie: Extachrome - 7242, ASA 125 - Forced developed ASA 500 Still: Tri-X-Pan-4164 Kodak Film, Polaroid
Exposure	Movie: F-1.9, 18 frames per second F=8-11, t=1/30 sec or 1 sec
Flow Meters	1) Fisher & Porter Co. Precision Flow rater No. 2F-1/4-20-5 Float CD-14 2) Fisher & Porter Co. Precision Flow rater No. B4-21-10 Float BSVT-45 3) Fisher & Porter Co. Precision Flow rator No. B6-35-10 Float BSVT-64
Heat Exchanger	CSU design; liquid nitrogen bath
Concentration System	
Counters	1) Ultra Scaler - Model 192A by Nuclear Chicago 2) Ortec timer model 482, Scaler model - 484 power supply model 446, amplifier model 485, ratemeter model 441
Radioactive Gas Samplers	1) N00014-68-A-0493-0001-65234 2) N00014-68-A-0493-0001-65227
Sampling Panels	Made at CSU, 25 sample point capacity for radioactive tracer sampling. Shown in Fig. 15.
Hewlett-Packard Model 5711-A-Gas Chromotograph	dual flame; ionization detector electrometer; isothermal oven controller; 1/2 cc dual sampling loops
Sampling Panels	Made at CSU; 16 sample point capacity per module; 4 modules. Shown in Fig. 14. Hewlett-Packard Integrating Digital Voltmeter Model 2401C
Velocity Control System	Datametrics linear Flowmeter Model 800-LV
Temperature Measurement System	YSI Precision Thermistor Model YSI 44004 Tele-Thermometer; Yellow Springs Corp., Model YSI 42 SC, range $-40^{o} \sim 150^{o}C$.

Table 4. 16mm Movie Sequence for Flow Visualization

1:200 High Dike in Meteorological Wind Tunnel. Model Gas of Freon-12 Nitrogen Mixture @ 22° C.

RUN NO.	WIND SPEED (ft/sec)	STRATIFICATION	BOILOFF (lbm/sec)
1	10	neutral	3,960
2	10	neutral	2,400
3	10	neutral	420
4	10	neutral	160
5	10	neutral	29
302	23	neutral	2,400
303	23	neutral	420
304	23	neutral	160
21	10	stable	3,960
22	10	stable	2,400
23	10	stable	420
24	10	stable	160
322	23	stable	2,400
323	23	stable	420
324	23	stable	160

High Dike in Environmental Wind Tunnel. Model Gas of Freon 12, Nitrogen Mixture @ 22°C.

RUN NO.	MODEL SCALE	WIND SPEED (ft/sec)	STRATIFICATION	BOILOFF (lbm/sec)
1E	1:200	10	neutral	3,960
2E	1:200	10	neutral	2,400
3E	1:200	10	neutral	420
50E	1:130	10	neutral	45
51E,55E	1:130	10	neutral	28
52E,56E	1:130	10	neutral	8
53E,57E	1:130	10	neutral	2

(cont'd)

Table 4. 16mm Movie Sequence for Flow Visualization (cont'd)

1:200 Low Dike in Meteorological Wind Tunnel. Model Gas of Freon 12, Nitrogen Mixture @ 22^{o}C.

RUN NO.	WIND DIRECTION	WIND SPEED (ft/sec)	STRATIFICATION	BOILOFF (lbm/sec)
10	0^{o}	10	neutral	2,534
11	0^{o}	10	neutral	1,400
12	0^{o}	10	neutral	275
13	0^{o}	10	neutral	116
14	0^{o}	10	neutral	94
15	45^{o}	10	neutral	2,534
16	45^{o}	10	neutral	1,400
17	45^{o}	10	neutral	275
18	45^{o}	10	neutral	116
19	45^{o}	10	neutral	94
316	45^{o}	23	neutral	1,400
317	45^{o}	23	neutral	275
318	45^{o}	23	neutral	116
30	0^{o}	10	stable	2,534
31	0^{o}	10	stable	1,400
32	0^{o}	10	stable	275
33	0^{o}	10	stable	116
34	0^{o}	10	stable	94
35	45^{o}	10	stable	2,534
36	45^{o}	10	stable	1,400
37	45^{o}	10	stable	275
38	45^{o}	10	stable	116
39	45^{o}	10	stable	94

1:200 Low Dike in Environmental Wind Tunnel. Model Gas of Freon 12, Nitrogen Mixture @ 22^{o} C.

RUN NO.	WIND DIRECTION	WIND SPEED (ft/sec)	STRATIFICATION	BOILOFF (lbm/sec)
10E	0^{o}	10	neutral	2,534
11E	0^{o}	10	neutral	1,400
12E	0^{o}	10	neutral	275
15E	45^{o}	10	neutral	2,534
16E	45^{o}	10	neutral	1,400
17E	45^{o}	10	neutral	275

(cont'd)

Table 4. 16mm Movie Sequence for Flow Visualization (cont'd)

1:200 High Dike in Meteorological Wind Tunnel. Model Gas of Helium, Nitrogen Mixture @ 111° K.

RUN NO.	WIND SPEED (ft/sec)	STRATIFICATION	BOILOFF (lbm/sec)
2C	10	neutral	2,400
3C	10	neutral	420
4C	10	neutral	160
22C	10	stable	2,400
23C	10	stable	420
24C	10	stable	160
322C	23	stable	2,400
323C	23	stable	420
324C	23	stable	160

1:200 Low Dike in Meteorological Wind Tunnel. Model Gas of Helium, Nitrogen Mixture @ 111° K.

RUN NO.	WIND DIRECTION	WIND SPEED (ft/sec)	STRATIFICATION	BOILOFF (lbm/sec)
16C	45°	10	neutral	1,400
17C	45°	10	neutral	275
18C	45°	10	neutral	116
36C	45°	10	stable	1,400
37C	45°	10	stable	275
38C	45°	10	stable	116
336C	45°	23	stable	1,400
337C	45°	23	stable	275
338C	45°	23	stable	116

(cont'd)

Table 4. 16mm Movie Sequence for Flow Visualization (cont'd)

Variable Boiloff Simulation in Meteorological Wind Tunnel.
Model Gas of Freon 12, Nitrogen Mixture @ 22° C.

RUN NO.	MODEL	WIND DIRECTION	WIND SPEED (ft/sec)	STRATIFI-CATION	GROUND MATERIAL
IV	1:200 High	0°	10	neutral	soil
IVA	1:200 High	0°	10	neutral	concrete
2V	1:200 High	0°	16	neutral	soil
3V	1:200 High	0°	23	neutral	soil
4V	1:200 Low	45°	10	neutral	soil
4VA	1:200 Low	45°	10	neutral	concrete
5V	1:200 Low	45°	16	neutral	soil
6V	1:200 Low	45°	23	neutral	soil

Table 5. Temperature - Concentration Data
For Selected Points in Cold He-N_2 Plumes

Run No.	X (ft)	Y (ft)	Z (ft)	Wall Distance (ft)	$(\frac{\Delta T}{\Delta T max}) X 100$	Per cent Methane
2C	450	0	0	316	13.3	31
	450	0	33	316	6.9	15
	450	0	67	316	7.4	10.5
	450	0	133	316	8.5	18.5
	450	0	200	316	8.0	10.5
	1050	0	0	866	3.7	7
302C	450	0	0	316	7.1	15
	450	0	33	316	4.9	5
	450	0	67	316	4.4	3
	450	0	133	316	3.8	3
	450	0	200	316	1.6	.6
	1050	0	0	866	1.1	2
22C	450	0	0	316	12.7	20
	450	0	33	316	13.8	19.5
	450	0	67	316	10.98	21.5
	450	0	133	316	10.98	10.
	450	0	200	316	2.89	1.
	1050	0	0	866	2.31	10
322C	450	0	0	316	8.7	22
	450	0	33	316	15.6	27
	450	0	67	316	17.3	22
	450	0	133	316	10.98	16.5
	450	0	200	316	1.16	1.6
	1050	0	0	866	2.3	7.8
3C	450	0	0	316	9.8	8.5
	450	0	33	316	5.2	5
	450	0	67	316	2.3	.8
	450	0	133	316	.6	.27
	450	0	200	316	0	.02
	1050	0	0	800	4.0	1.5
303C	450	0	0	316	2.3	3.5
	450	0	33	316	2.3	1.8
	450	0	67	316	1.7	1.2
	450	0	133	316	.57	.4
	450	0	200	316	0	.02
	1050	0	0	800	1.15	1.4
23C	450	0	0	316	10.4	20.5
323C	450	0	0	316	8.9	10.2

(cont'd)

Table 5 (cont'd) Temperature - Concentration Data For Selected Points in Cold He-N_2 Plumes

Run No.	X (ft)	Y (ft)	Z (ft)	Wall Distance (ft)	$(\frac{\Delta T}{\Delta T max})$ X 100	Per cent Methane
4C	450	0	0	316	2.3	3.0
	450	0	33	316	2.3	1.3
	450	0	67	316	1.7	.21
	450	0	133	316	.58	.04
	450	0	200	316	0	.03
	1050	0	0	800	4.62	.9
304C	450	0	0	316	4.6	.3
	450	0	33	316	1.7	.6
	450	0	67	316	1.15	.2
	450	0	133	316	0	.03
	450	0	200	316	0	.01
	1050	0	0	800	1.15	.34
24C	450	0	0	316	8.05	7.5
324C	450	0	0	316	7.5	.7
16C	450	0	0	316	11.17	4
	450	0	33	316	1.68	.16
	450	0	67	316	0	.09
	450	0	133	316	0	.03
	450	0	200	316	0	.06
	1050	0	0	800	2.79	3.
316C	450	0	0	316	3.11	2.5
	450	0	33	316	2.07	1.0
	450	0	67	316	1.04	.11
	450	0	133	316	.52	.01
	450	0	200	316	.52	.06
	1050	0	0	800	3.11	1.13
36C	450	0	0	316	7.51	7.0
	450	0	33	316	8.67	2.0
	450	0	67	316	2.31	.25
	450	0	133	316	1.16	.09
	450	0	200	316	.58	.04
	1050	0	0	800	1.73	3.3
336C	450	0	0	316	8.67	2.5
	450	0	33	316	3.47	.78
	450	0	67	316	0	.24
	450	0	133	316	0	.11
	450	0	200	316	0	.07
	1050	0	0	800	3.47	5.5

(cont'd)

Table 5 (cont'd)

Temperature - Concentration Data
For Selected Points in Cold $He-N_2$ Plumes

Run No.	X (ft)	Y (ft)	Z (ft)	Wall Distance (ft)	$(\frac{\Delta T}{\Delta T_{max}}) \times 100$	Per cent Methane
17C	450	0	0	316	8.94	3.00
317C	450	0	0	316	3.39	.21
37C	450	0	0	316	6.47	1.5
337C	450	0	0	316	9.25	1.5
18C	450	0	0	316	8.0	1.5
318C	450	0	0	316	4.0	.14
38C	450	0	0	316	7.65	1.5
338C	450	0	0	316	4.71	1.0

Table 6. Approximate Distances (ft) Downwind to the LFL
(Obtain by simulation gas of M.W. 40.6 @ 70°F)

Model	Wind Direction	Boiloff (lbm/sec)	neutral 10 ft/sec	neutral 16 ft/sec	neutral 23 ft/sec	stable 10 ft/sec	stable 16 ft/sec	stable 23 ft/sec
High	0	3960	>6000					
		2400	5500	3700	1500	1400	1200	1500
		420	1000	500	<400	800	800	800
		160	600	<400	<400	500	<450	<450
		29	<300					
Low	0	2534	6500					
		850	1550					
		275	450					
		116	<300					
		94	<300					
	45	2534	5300					1400
		850	1600	1700	<400	800	800	800
		275	500	<400	<400	600	700	600
		116	<300	<400	<400	<450	450	<450
		94	<300					

Table 7. Approximate Distances (ft) Downwind to the LFL
(Obtain by simulation gas of M.W. 16 @ -260 °F)

Model	Wind Direction	Boiloff (lbm/sec)	neutral 10 ft/sec	neutral 16 ft/sec	neutral 23 ft/sec	stable 10 ft/sec	stable 16 ft/sec	stable 23 ft/sec
High	0	3960						
		2400	>6600		1000	>6600		6600
		420	6000		800	3400		2900
		160	700		<450	1300		<450
		29						
Low	0	2534						
		850						
		275						
		116						
		94						
	45	2534						
		850	1700		800	2700		2900
		275	450		<450	550		1400
		116	<450		<450	<450		<450
		94						

Table 8. Locator Table for Vertical Concentration Profiles.

Model	Wind Direction	Boiloff (lbm/sec)	neutral 10 ft/sec	neutral 16 ft/sec	neutral 23 ft/sec	stable 10 ft/sec	stable 16 ft/sec	stable 23 ft/sec
High	0	3,960						
		2,400	A*					
		420	B		C			
		160	D					
		29						
Low	0	2,534						
		850						
		275						
		116						
		94						
	45	2,534						
		850	1,E		2,F	3,G		4,H
		275						
		116						
		94						

* Alphebetic sequence represent simulation gas of M.W. 16 @ -260°F. Numeric Sequence represent simulation gas of M.W. 40.6 @ 70°F.

Table 9. Locator Table for Dimensionless Concentration Coefficient vs. Dimensionless Downwind Distance

Model	Wind Direction	Boiloff (lbm/sec)	neutral			stable		
			10 ft/sec	16 ft/sec	23 ft/sec	10 ft/sec	16 ft/sec	23 ft/sec
High	0	3960	1,2					
		2400	1,A*	1	2,B	3,C	3	3,C
		420	2,A	2	2,B	4,D	4	4,D
		160	2,A	2	2,B	4,D	4	4,D
Low	0	2534	5,5					
		850	5					
		275	5					
		116	5					
	45	2534	6,7					
		850	6,E	6	7,F	8,G	8	8,H
		275	7,E	7	7,F	9,G	9	9,H
		116	7,E	7	7,F	9,G	9	9,H

*Alphebetic sequence represent simulation gas of M.W. 16 @ -260°F. Numeric Sequence represent simulation gas of M.W. 40.6 @ 70°F.

Table 10. Locator Table For Concentration Results

Model	Wind Direction	Boiloff (lbm/sec)	neutral 10 ft/sec	neutral 16 ft/sec	neutral 23 ft/sec	stable 10 ft/sec	stable 16 ft/sec	stable 23 ft/sec
High	0	3960	1,2,3					
		2400	4,5,6,7	8	9,10,11	12,13,14	15	16,17,18
		420	19,20,21	22	23,24	25,26	27	28,29
		160	30,31,32,33	34	35,36,37	38,39,40	41	42,43,44
		29	45					
Low	0	2534	46,47					
		850	48			49		50
		275	51					
		116	52			53		54
		94	55					
	45	2534	56,57					58
		850	59,60,61	62	63,64,65	66,67,68	69	70,71,72
		275	73,74	75	76,77	78,79	80	81,82
		116	83,84,85	86	87,88,89	90,91,92	93	94,95,96
		94	97					

RUN NUMBER 1

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	2
TIME EQUIVALENT	1 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	3960 LBM/SEC	FLOW RATE	3.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	40.85	1.4
270	-130	0	34.65	1.2
300	0	0	5.73	.20
270	130	0	37.63	1.3
187	234	0	43.45	1.5
702	-384	0	32.88	1.1
775	-198	0	27.06	.94
800	0	0	25.16	.88
775	198	0	28.01	.97
702	384	0	32.50	1.1
1343	-395	0	26.23	.91
1386	-200	0	24.65	.86
1400	0	0	24.65	.86
1386	200	0	21.17	.74
1343	395	0	25.41	.88
2367	-398	0	21.30	.74
2392	-200	0	19.91	.69
2400	0	0	17.18	.60
2392	200	0	3.89	.14
2367	398	0	18.89	.66
3578	-399	0	17.18	.60
3594	-200	0	16.74	.58
3600	0	0	13.26	.46
3594	200	0	15.98	.56
3578	399	0	14.46	.50
4984	-400	0	11.17	.39
4996	-200	0	13.64	.47
5000	0	0	11.36	.40
4996	200	0	14.21	.49
4984	400	0	13.07	.45
6000	0	0	11.04	.38
0	0	0	0.00	0.

Table 10-1

RUN NUMBER 101

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-500
DIKE MATERIAL	SOIL	GRID TYPE	7
TIME EQUIVALENT	1 SEC	WIND SPEED	.44 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	3960 LBM/SEC	FLOW RATE	.26 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
105	-489	0	23.14	1.1
389	-314	0	22.22	1.0
500	0	0	19.16	.90
389	314	0	26.36	1.2
105	489	0	27.43	1.3
866	-901	0	8.50	.40
1150	-490	0	9.06	.42
1250	0	0	9.21	.43
1150	490	0	8.91	.42
866	901	0	7.79	.36
1754	-961	0	4.78	.22
1938	-496	0	4.93	.23
2000	0	0	4.32	.20
1938	496	0	4.62	.22
1754	961	0	3.76	.18
3358	-987	0	2.22	.10
3464	-499	0	2.89	.13
3500	0	0	2.68	.13
3464	499	0	2.33	.11
3358	987	0	2.28	.11
4900	-994	0	1.51	.71E-01
4975	-499	0	1.66	.78E-01
5000	0	0	1.56	.73E-01
4975	499	0	1.82	.85E-01
4900	994	0	1.36	.63E-01
5917	-996	0	.74	.35E-01
5979	-500	0	1.31	.61E-01
6000	0	0	.69	.32E-01
5979	500	0	1.26	.59E-01
5917	996	0	1.26	.59E-01
0	0	0	0.00	0.
0	0	0	0.00	0.

Table 10-2

RUN NUMBER 101A

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-500
DIKE MATERIAL	SOIL	GRID TYPE	3
TIME EQUIVALENT	1 SEC	WIND SPEED	.44 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	3960 LBM/SEC	FLOW RATE	.26 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
468	-585	0	12.04	.56
675	-325	0	13.55	.63
750	0	0	2.28	.11
675	325	0	1.86	.87E-01
468	585	0	13.68	.64
1755	-960	0	1.25	.58E-01
1938	-495	0	3.68	.17
2000	0	0	2.40	.11
1938	495	0	2.95	.14
1755	960	0	1.07	.50E-01
3358	-988	0	.38	.18E-01
3465	-500	0	.95	.44E-01
3500	0	0	.83	.39E-01
3465	500	0	.83	.39E-01
3358	988	0	.38	.18E-01
5918	-995	0	.15	.72E-02
5980	-500	0	.19	.89E-02
6000	0	0	.21	.10E-01
5980	500	0	.01	.68E-03
5918	995	0	.12	.55E-02
8945	-998	0	.12	.58E-02
8985	-500	0	.14	.63E-02
9000	0	0	.14	.63E-02
8985	500	0	.15	.72E-02
8945	998	0	.15	.69E-02
12460	-1000	0	.10	.46E-02
12490	-500	0	.09	.44E-02
12500	0	0	.11	.49E-02
12490	500	0	.14	.66E-02
12460	1000	0	.15	.69E-02
15000	0	0	.11	.52E-02
0	0	0	0.00	0.

Table 10-3

RUN NUMBER 2

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	2
TIME EQUIVALENT	1	120 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	35.41	2.0
270	-130	0	35.60	2.0
300	0	0	10.92	.60
270	130	0	38.26	2.1
187	234	0	34.72	1.9
702	-384	0	25.09	1.4
775	-198	0	20.79	1.1
800	0	0	19.15	1.1
775	198	0	22.50	1.2
702	384	0	21.61	1.2
1343	-395	0	18.39	1.0
1386	-200	0	19.08	1.1
1400	0	0	17.63	.97
1386	200	0	16.61	.92
1343	395	0	16.99	.94
2367	-398	0	12.63	.70
2392	-200	0	14.34	.79
2400	0	0	11.42	.63
2392	200	0	3.20	.18
2367	398	0	11.17	.62
3578	-399	0	10.35	.57
3594	-200	0	10.35	.57
3600	0	0	8.20	.45
3594	200	0	9.40	.52
3578	399	0	8.83	.49
4984	-400	0	6.74	.37
4996	-200	0	8.01	.44
5000	0	0	6.49	.36
4996	200	0	8.20	.45
4984	400	0	7.69	.42
6000	0	0	6.68	.37
0	0	0	0.00	0.

Table 10-4

RUN NUMBER 2V

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	5
TIME EQUIVALENT	1	120 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	42.79	2.4
450	0	17	25.23	1.4
450	0	33	4.66	.26
450	0	67	1.48	.82E-01
450	0	133	.18	.10E-01
450	0	200	.04	.24E-02
1023	-232	0	23.01	1.3
1023	-232	33	8.41	.46
1023	-232	100	1.71	.94E-01
1023	-232	167	.03	.17E-02
1050	0	0	19.78	1.1
1050	0	17	14.83	.82
1050	0	33	8.07	.44
1050	0	67	3.75	.21
1050	0	133	.29	.16E-01
1050	0	200	.04	.20E-02
1023	232	0	18.58	1.0
1023	232	33	7.73	.43
1023	232	100	5.29	.29
1023	232	167	.17	.95E-02
2050	0	0	9.09	.50
3450	0	0	5.86	.32
3450	0	67	1.82	.10
3450	0	200	.44	.24E-01
3450	0	300	.02	.11E-02
3450	0	400	0.00	0.
5050	0	0	.91	.50E-01
5050	0	67	.97	.53E-01
5050	0	200	.31	.17E-01
5050	0	300	.09	.52E-02
5050	0	400	.06	.33E-02
6650	0	0	1.93	.11

Table 10-5

RUN NUMBER 2A

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	1
TIME EQUIVALENT	1	120 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
165	-230	0	32.66	1.8
252	-130	0	37.13	2.0
283	0	0	27.77	1.5
252	130	0	0.00	0.
165	230	0	30.32	1.7
490	-373	0	26.70	1.5
584	-197	0	26.91	1.5
617	0	0	19.89	1.1
584	197	0	22.02	1.2
490	373	0	24.15	1.3
1134	-393	0	20.74	1.1
1183	-199	0	18.62	1.0
1200	0	0	16.70	.92
1183	199	0	13.94	.77
1134	393	0	14.36	.79
2569	-399	0	12.66	.70
2592	-200	0	5.85	.32
2600	0	0	10.11	.56
2592	200	0	0.00	0.
2569	399	0	6.91	.38
3913	-399	0	5.64	.31
3928	-200	0	7.68	.42
3933	0	0	7.36	.41
3928	200	0	6.02	.33
3913	399	0	2.55	.14
5235	-400	0	2.53	.14
5246	-200	0	.40	.22E-01
5250	0	0	1.36	.75E-01
5246	200	0	1.96	.11
5235	400	0	1.68	.93E-01
0	0	0	0.00	0.
0	0	0	0.00	0.

Table 10-6

RUN NUMBER 2C

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL CONCRETE	SOIL	GRID TYPE	6
TIME EQUIVALENT 1	120 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	5 C
WIND SPEED	9.8 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	-170 C
BOIL OFF RATE	2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	29.78	1.6
415	-163	0	24.78	1.4
450	0	0	27.35	1.5
*450	0	33	14.74	.81
*450	0	67	10.47	.58
*450	0	133	18.36	1.0
*450	0	200	10.26	.57
415	163	0	13.83	.76
317	298	0	13.06	.72
*971	-390	0	.72	.39E-01
1030	-199	0	7.39	.41
*1030	-199	33	11.01	.61
*1030	-199	100	3.97	.22
*1030	-199	167	1.16	.64E-01
*1050	0	0	7.00	.39
*1050	0	33	13.46	.74
*1050	0	67	9.13	.50
*1050	0	133	11.02	.61
*1050	0	200	4.89	.27
1030	199	0	19.28	1.1
*1030	199	33	.51	.28E-01
*1030	199	100	2.68	.15
*1030	199	167	2.65	.15
*971	390	0	.10	.54E-02
2010	-398	0	3.07	.17
2040	-200	0	25.94	1.4
2050	0	0	7.82	.43
*2050	0	50	7.12	.39
*2050	0	100	4.87	.27
*2050	0	200	5.60	.31
*2050	0	300	2.49	.14
2040	200	0	22.25	1.2
2010	398	0	2.74	.15
3426	-399	0	6.88	.38
3444	-200	0	4.81	.27
3450	0	0	23.75	1.3
*3450	0	67	4.31	.24
*3450	0	200	2.82	.16
*3450	0	300	1.05	.58E-01
*3450	0	400	1.41	.78E-01
3444	200	0	6.03	.33
3426	399	0	9.55	.53
5044	-232	0	5.27	.29
5050	0	0	20.00	1.1
5050	0	67	1.58	.87E-01
5050	0	200	2.72	.15
5050	0	300	.41	.23E-01
5050	0	400	.20	.11E-01
5044	232	0	3.92	.22
6650	0	0	11.11	.61

Table 10-7

RUN NUMBER 202

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	4
TIME EQUIVALENT	1	120 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	25.60	2.4
365	-163	0	19.46	1.8
400	0	0	5.82	.54
365	163	0	15.65	1.5
267	298	0	22.81	2.1
921	-390	0	11.39	1.1
980	-199	0	7.59	.71
1000	0	0	1.90	.18
980	199	0	4.18	.39
921	390	0	11.51	1.1
1960	-398	0	6.90	.65
1990	-200	0	7.07	.66
2000	0	0	2.53	.24
1990	200	0	5.77	.54
1960	398	0	6.05	.57
2000	0	17	1.11	.10
2000	0	33	.71	.66E-01
2000	0	67	.33	.31E-01
2000	0	133	.35	.32E-01
2000	0	200	.05	.43E-02
3376	-399	0	2.59	.24
3394	-200	0	2.87	.27
3400	0	0	2.53	.24
3394	200	0	4.18	.39
3376	399	0	3.04	.28
4984	-400	0	1.22	.11
4996	-200	0	2.93	.27
5000	0	0	.88	.82E-01
4996	200	0	2.07	.19
4984	400	0	2.70	.25
6600	0	0	0.00	0.
0	0	0	0.00	0.

Table 10-8

RUN NUMBER 302

PROTOTYPE CONDITIONS

DIKE CONFIGURATION			HIGH
DIKE MATERIAL	CONCRETE		SOIL
TIME EQUIVALENT		1	120 SEC
WIND DIRECTION			0
WIND SPEED			23.0 FT/S
STRATIFICATION			NEUTRAL
BOIL OFF RATE			2400 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	4
WIND SPEED	1.62 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	23.59	3.2
365	-163	0	10.03	1.4
400	0	0	1.78	.24
365	163	0	10.08	1.4
267	298	0	23.06	3.2
921	-390	0	7.05	.97
980	-199	0	3.32	.46
1000	0	0	.77	.11
980	199	0	1.89	.26
921	390	0	6.25	.86
1960	-398	0	3.01	.41
1990	-200	0	1.25	.17
2000	0	0	.56	.77E-01
1990	200	0	.66	.91E-01
1960	398	0	2.05	.28
2000	0	17	.44	.60E-01
2000	0	33	.36	.49E-01
2000	0	67	.15	.20E-01
2000	0	133	.09	.12E-01
2000	0	200	0.00	0.
3376	-399	0	2.63	.36
3394	-200	0	1.20	.16
3400	0	0	.32	.44E-01
3394	200	0	.33	.45E-01
3376	399	0	.85	.12
4984	-400	0	.85	.12
4996	-200	0	.93	.13
5000	0	0	.22	.31E-01
4996	200	0	.24	.34E-01
4984	400	0	.27	.37E-01
6600	0	0	.38	.52E-01
0	0	0	0.00	0.

Table 10-9

RUN NUMBER 302V

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL CONCRETE	SOIL	GRID TYPE	5
TIME EQUIVALENT 1	120 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	2.75	.38
450	0	17	1.80	.25
450	0	33	.67	.92E-01
450	0	67	.78	.11
450	0	133	.16	.21E-01
450	0	200	.05	.67E-02
1023	-232	0	5.38	.74
1023	-232	33	1.69	.23
1023	-232	100	.13	.18E-01
1023	-232	167	.03	.44E-02
1050	0	0	1.29	.18
1050	0	17	1.01	.14
1050	0	33	.72	.99E-01
1050	0	67	.37	.51E-01
1050	0	133	.12	.16E-01
1050	0	200	.05	.75E-02
1023	232	0	.55	.76E-01
1023	232	33	1.63	.22
1023	232	100	1.12	.15
1023	232	167	.05	.75E-02
2050	0	0	4.08	.56
3450	0	0	4.19	.57
3450	0	67	.95	.13
3450	0	200	.11	.15E-01
3450	0	300	.03	.36E-02
3450	0	400	.03	.36E-02
5050	0	0	2.20	.30
5050	0	67	.87	.12
5050	0	200	.20	.27E-01
5050	0	300	.07	.98E-02
5050	0	400	.03	.36E-02
6650	0	0	2.18	.30

Table 10-10

RUN NUMBER 302C

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	6
TIME EQUIVALENT	1	120 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		23.0 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	-160 C
BOIL OFF RATE		2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	.21	.28E-01
415	-163	0	5.20	.71
450	0	0	13.41	1.8
*450	0	33	4.54	.62
*450	0	67	2.92	.40
*450	0	133	2.62	.36
*450	0	200	.59	.81E-01
415	163	0	7.56	1.0
317	298	0	1.41	.19
*971	-390	0	4.05	.55
1030	-199	0	.89	.12
*1030	-199	33	1.80	.25
*1030	-199	100	.29	.39E-01
*1030	-199	167	.09	.12E-01
*1050	0	0	2.02	.28
*1050	0	33	1.67	.23
*1050	0	67	1.82	.25
*1050	0	133	1.36	.19
*1050	0	200	.98	.13
1030	199	0	1.82	.25
*1030	199	33	1.73	.24
*1030	199	100	1.07	.15
*1030	199	167	.11	.15E-01
*971	390	0	.86	.12
2010	-398	0	.08	.11E-01
2040	-200	0	.28	.39E-01
2050	0	0	.81	.11
*2050	0	50	1.15	.16
*2050	0	100	1.11	.15
*2050	0	200	.67	.92E-01
*2050	0	300	.21	.29E-01
2040	200	0	.38	.52E-01
2010	398	0	.02	.26E-02
3426	-399	0	.11	.14E-01
3444	-200	0	.16	.22E-01
3450	0	0	.50	.68E-01
*3450	0	67	.72	.98E-01
*3450	0	200	.66	.90E-01
*3450	0	300	.18	.25E-01
*3450	0	400	.03	.35E-02
3444	200	0	.15	.20E-01
3426	399	0	.18	.25E-01
5044	-232	0	.33	.46E-01
5050	0	0	.44	.60E-01
5050	0	67	.50	.69E-01
5050	0	200	1.68	.23
5050	0	300	.75	.10
5050	0	400	.22	.31E-01
5044	232	0	.11	.15E-01
6650	0	0	.52	.72E-01

Table 10-11

RUN NUMBER 22

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		HIGH
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	120 SEC
WIND DIRECTION		0
WIND SPEED		9.8 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		2400 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	9
WIND SPEED	.71 FT/S
STRATIFICATION	23 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	38.87	1.4
415	-163	0	42.94	1.6
450	0	0	54.30	2.0
415	163	0	49.72	1.8
317	298	0	43.17	1.6
971	-390	0	8.31	.31
1030	-199	0	9.21	.34
1050	0	0	7.18	.27
1030	199	0	5.88	.22
971	390	0	4.64	.17
2010	-398	0	2.00	.74E-01
2040	-200	0	2.69	.99E-01
2050	0	0	2.77	.10
2040	200	0	2.76	.10
2010	398	0	2.77	.10
2050	0	17	2.79	.10
2050	0	33	2.69	.99E-01
2050	0	67	2.67	.99E-01
2050	0	133	1.71	.63E-01
2050	0	200	.80	.30E-01
3426	-399	0	2.02	.74E-01
3444	-200	0	2.57	.95E-01
3450	0	0	2.95	.11
3444	200	0	3.12	.12
3426	399	0	2.89	.11
5034	-400	0	1.13	.42E-01
5046	-200	0	1.46	.54E-01
5050	0	0	2.00	.74E-01
5046	200	0	2.42	.89E-01
5034	400	0	2.25	.83E-01
6650	0	0	.29	.11E-01
0	0	0	0.00	0.

Table 10-12

RUN NUMBER 22V

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		HIGH
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	120 SEC
WIND DIRECTION		0
WIND SPEED		9.8 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		2400 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	5
WIND SPEED	.71 FT/S
STRATIFICATION	23 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	32.41	1.2
450	0	17	7.18	.27
450	0	33	.18	.68E-02
450	0	67	1.84	.68E-01
450	0	133	.95	.35E-01
450	0	200	.45	.16E-01
1023	-232	0	6.27	.23
1023	-232	33	4.45	.16
1023	-232	100	.80	.30E-01
1023	-232	167	.27	.10E-01
1050	0	0	5.83	.22
1050	0	17	5.68	.21
1050	0	33	3.78	.14
1050	0	67	1.59	.59E-01
1050	0	133	.88	.33E-01
1050	0	200	.52	.19E-01
1023	232	0	4.70	.17
1023	232	33	3.44	.13
1023	232	100	1.07	.40E-01
1023	232	167	.73	.27E-01
2050	0	0	2.05	.76E-01
3450	0	0	1.20	.44E-01
3450	0	67	.56	.21E-01
3450	0	200	.34	.13E-01
3450	0	300	.05	.17E-02
3450	0	400	0.00	0.
5050	0	0	.12	.45E-02
5050	0	67	.07	.27E-02
5050	0	200	.17	.62E-02
5050	0	300	.10	.36E-02
5050	0	400	.08	.30E-02
6650	0	0	0.00	0.

Table 10-13

RUN NUMBER 22

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL CONCRETE	SOIL	GRID TYPE	6
TIME EQUIVALENT 1	120 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	25 C
WIND SPEED	9.8 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	-175 C
BOIL OFF RATE	2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	4.81	.16
415	-163	0	8.92	.33
450	0	0	20.46	.76
*450	0	33	19.50	.72
*450	0	67	21.67	.80
*450	0	133	9.98	.37
*450	0	200	1.04	.39E-01
415	163	0	15.99	.59
317	298	0	4.77	.18
*971	-390	0	.24	.90E-02
1030	-199	0	17.29	.64
*1030	-199	33	13.63	.50
*1030	-199	100	6.26	.23
*1030	-199	167	.48	.18E-01
*1050	0	0	10.17	.38
*1050	0	33	16.33	.60
*1050	0	67	19.94	.74
*1050	0	133	3.51	.13
*1050	0	200	2.37	.87E-01
1030	199	0	15.39	.57
*1030	199	33	16.19	.60
*1030	199	100	.33	.12E-01
*1030	199	167	.53	.19E-01
*971	390	0	4.80	.18
2010	-398	0	3.85	.14
2040	-200	0	5.67	.21
2050	0	0	8.91	.33
*2050	0	50	15.74	.58
*2050	0	100	4.17	.15
*2050	0	200	1.14	.42E-01
*2050	0	300	.52	.19E-01
2040	200	0	17.02	.63
2010	398	0	12.26	.45
3426	-399	0	.40	.15E-01
3444	-200	0	4.45	.16
3450	0	0	8.14	.30
*3450	0	67	6.10	.23
*3450	0	200	.39	.14E-01
*3450	0	300	.58	.21E-01
*3450	0	400	.09	.33E-02
3444	200	0	11.79	.44
3426	399	0	11.47	.42
5044	-232	0	7.78	.29
5050	0	0	13.72	.51
5050	0	67	6.51	.24
5050	0	200	.28	.10E-01
5050	0	300	.11	.42E-02
5050	0	400	.02	.80E-03
5044	232	0	11.17	.41
6650	0	0	9.34	.34

Table 10-14

RUN NUMBER 222

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	9
TIME EQUIVALENT	1	120 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION		0	STRATIFICATION	24 C
WIND SPEED		16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	33.87	2.0
415	-163	0	40.25	2.4
450	0	0	43.60	2.6
415	163	0	45.25	2.7
317	298	0	49.30	3.0
971	-390	0	5.20	.31
1030	-199	0	4.99	.30
1050	0	0	5.62	.34
1030	199	0	6.21	.37
971	390	0	5.57	.34
2010	-398	0	1.42	.86E-01
2040	-200	0	1.58	.95E-01
2050	0	0	1.49	.90E-01
2040	200	0	1.52	.92E-01
2010	398	0	1.95	.12
2050	0	17	1.77	.11
2050	0	33	2.92	.18
2050	0	67	2.40	.14
2050	0	133	.78	.47E-01
2050	0	200	.58	.35E-01
3426	-399	0	1.32	.80E-01
3444	-200	0	2.01	.12
3450	0	0	2.10	.13
3444	200	0	2.63	.16
3426	399	0	1.70	.10
5034	-400	0	1.07	.65E-01
5046	-200	0	1.36	.82E-01
5050	0	0	1.19	.72E-01
5046	200	0	2.01	.12
5034	400	0	1.85	.11
6650	0	0	.36	.22E-01
0	0	0	0.00	0.

Table 10-15

RUN NUMBER 322

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		HIGH
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	120 SEC
WIND DIRECTION		0
WIND SPEED		23.0 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		2400 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	9
WIND SPEED	1.62 FT/S
STRATIFICATION	18 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	26.20	2.2
415	-163	0	34.05	2.9
450	0	0	34.82	2.9
415	163	0	41.69	3.5
317	298	0	32.92	2.8
971	-390	0	9.48	.80
1030	-199	0	10.10	.85
1050	0	0	8.46	.71
1030	199	0	6.82	.57
971	390	0	4.87	.41
2010	-398	0	.82	.69E-01
2040	-200	0	.71	.60E-01
2050	0	0	1.33	.11
2040	200	0	1.69	.14
2010	398	0	2.15	.18
2050	0	17	1.74	.15
2050	0	33	2.30	.19
2050	0	67	1.53	.13
2050	0	133	1.43	.12
2050	0	200	.06	.48E-02
3426	-399	0	.92	.77E-01
3444	-200	0	1.23	.10
3450	0	0	1.23	.10
3444	200	0	1.43	.12
3426	399	0	1.12	.95E-01
5034	-400	0	.16	.14E-01
5046	-200	0	.71	.60E-01
5050	0	0	.76	.64E-01
5046	200	0	.97	.82E-01
5034	400	0	.71	.60E-01
6650	0	0	.76	.64E-01
0	0	0	0.00	0.

Table 10-16

RUN NUMBER 322V

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	5
TIME EQUIVALENT	1	120 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION		0	STRATIFICATION	22 C
WIND SPEED		23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	41.57	3.5
450	0	17	12.40	1.0
450	0	33	2.76	.23
450	0	67	2.06	.17
450	0	133	.53	.44E-01
450	0	200	.11	.95E-02
1023	-232	0	7.38	.62
1023	-232	33	3.03	.26
1023	-232	100	1.35	.11
1023	-232	167	.32	.27E-01
1050	0	0	6.82	.57
1050	0	17	5.96	.50
1050	0	33	3.95	.33
1050	0	67	2.11	.18
1050	0	133	1.31	.11
1050	0	200	.11	.95E-02
1023	232	0	8.28	.70
1023	232	33	3.59	.30
1023	232	100	.87	.73E-01
1023	232	167	.26	.22E-01
2050	0	0	2.34	.20
3450	0	0	1.57	.13
3450	0	67	.73	.61E-01
3450	0	200	.15	.12E-01
3450	0	300	0.00	0.
3450	0	400	0.00	0.
5050	0	0	.71	.60E-01
5050	0	67	.39	.33E-01
5050	0	200	.14	.12E-01
5050	0	300	.03	.23E-02
5050	0	400	.01	.12E-02
6650	0	0	0.00	0.

Table 10-17

RUN NUMBER 322C

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL CONCRETE	SOIL	GRID TYPE	6
TIME EQUIVALENT 1	120 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	0	STRATIFICATION	26 C
WIND SPEED	23.0 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	-175 C
BOIL OFF RATE	2400 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	1.17	.99E-01
415	-163	0	4.78	.40
450	0	0	22.04	1.9
*450	0	33	27.17	2.3
*450	0	67	22.40	1.9
*450	0	133	16.43	1.4
*450	0	200	1.62	.14
415	163	0	17.47	1.5
317	298	0	6.83	.58
*971	-390	0	.31	.26E-01
1030	-199	0	.47	.40E-01
*1030	-199	33	.88	.74E-01
*1030	-199	100	3.58	.30
*1030	-199	167	.35	.30E-01
*1050	0	0	7.80	.66
*1050	0	33	13.05	1.1
*1050	0	67	17.75	1.5
*1050	0	133	3.78	.32
*1050	0	200	1.04	.87E-01
1030	199	0	11.11	.94
*1030	199	33	14.90	1.3
*1030	199	100	.76	.64E-01
*1030	199	167	.59	.50E-01
*971	390	0	.19	.16E-01
2010	-398	0	.02	.15E-02
2040	-200	0	2.95	.25
2050	0	0	8.56	.72
*2050	0	50	11.18	.94
*2050	0	100	4.42	.37
*2050	0	200	.82	.69E-01
*2050	0	300	.08	.69E-02
2040	200	0	15.14	1.3
2010	398	0	10.02	.84
3426	-399	0	.22	.18E-01
3444	-200	0	2.34	.20
3450	0	0	6.51	.55
*3450	0	67	5.60	.47
*3450	0	200	.47	.39E-01
*3450	0	300	.21	.18E-01
*3450	0	400	.06	.54E-02
3444	200	0	10.12	.85
3426	399	0	9.08	.76
5044	-232	0	4.43	.37
5050	0	0	11.96	1.0
5050	0	67	3.93	.33
5050	0	200	.51	.43E-01
5050	0	300	.11	.95E-02
5050	0	400	.01	.79E-03
5044	232	0	10.42	.88
6650	0	0	6.20	.52

Table 10-18

RUN NUMBER 3

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		HIGH	
DIKE MATERIAL	CONCRETE	SOIL	
TIME EQUIVALENT	120	270	SEC
WIND DIRECTION		0	
WIND SPEED		9.8	FT/S
STRATIFICATION		NEUTRAL	
BOIL OFF RATE		420	LBM/SEC

MODEL CONDITIONS

SCALE	1-200	
GRID TYPE	2	
WIND SPEED	.71	FT/S
STRATIFICATION	0	C
RELEASE GAS	40.6	MW
RELEASE GAS TEMP.	22	C
FLOW RATE	.43	CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	13.77	4.2
270	-130	0	7.63	2.3
300	0	0	2.56	.79
270	130	0	7.75	2.4
187	234	0	11.99	3.7
702	-384	0	3.83	1.2
775	-198	0	2.06	.63
800	0	0	1.04	.32
775	198	0	2.18	.67
702	384	0	3.58	1.1
1343	-395	0	1.55	.48
1386	-200	0	.79	.24
1400	0	0	.37	.11
1386	200	0	.79	.24
1343	395	0	1.04	.32
2367	-398	0	.39	.12
2392	-200	0	.52	.16
2400	0	0	.32	.97E-01
2392	200	0	.33	.10
2367	398	0	.37	.11
3578	-399	0	.39	.12
3594	-200	0	.32	.99E-01
3600	0	0	.32	.99E-01
3594	200	0	.28	.88E-01
3578	399	0	.25	.76E-01
4984	-400	0	.21	.64E-01
4996	-200	0	.23	.70E-01
5000	0	0	.21	.64E-01
4996	200	0	.21	.64E-01
4984	400	0	.21	.64E-01
6000	0	0	.17	.53E-01
0	0	0	0.00	0.

Table 10-19

RUN NUMBER 3A

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		HIGH
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	120	270 SEC
WIND DIRECTION		0
WIND SPEED		9.8 FT/S
STRATIFICATION		NEUTRAL
BOIL OFF RATE		420 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	1
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
165	-230	0	13.34	4.1
252	-130	0	6.68	2.1
283	0	0	2.11	.65
252	130	0	4.27	1.3
165	230	0	9.73	3.0
490	-373	0	7.57	2.3
584	-197	0	4.32	1.3
617	0	0	8.57	2.6
584	197	0	9.55	2.9
490	373	0	5.55	1.7
1134	-393	0	3.64	1.1
1183	-199	0	2.05	.63
1200	0	0	.38	.12
1183	199	0	.89	.27
1134	393	0	2.14	.66
2569	-399	0	2.23	.69
2592	-200	0	1.77	.55
2600	0	0	.27	.84E-01
2592	200	0	.27	.84E-01
2569	399	0	1.45	.45
3913	-399	0	1.02	.31
3928	-200	0	1.09	.34
3933	0	0	1.05	.32
3928	200	0	.42	.13
3913	399	0	.69	.21
5235	-400	0	.72	.22
5246	-200	0	.26	.80E-01
5250	0	0	.32	.98E-01
5246	200	0	.41	.13
5235	400	0	.36	.11
0	0	0	0.00	0.
0	0	0	0.00	0.

Table 10-20

RUN NUMBER 3C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		HIGH
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	120	270 SEC
WIND DIRECTION		0
WIND SPEED		9.8 FT/S
STRATIFICATION		NEUTRAL
BOIL OFF RATE		420 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	6
WIND SPEED	.71 FT/S
STRATIFICATION	B C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-150 C
FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	8.13	2.5
415	-163	0	15.55	4.8
450	0	0	8.40	2.6
*450	0	33	5.29	1.6
*450	0	67	.80	.25
*450	0	133	.27	.83E-01
*450	0	200	.02	.75E-02
415	163	0	1.40	.43
317	298	0	.22	.68E-01
*971	-390	0	.64	.20
1030	-199	0	10.23	3.1
*1030	-199	33	2.04	.63
*1030	-199	100	.15	.46E-01
*1030	-199	167	.02	.77E-02
*1050	0	0	1.56	.48
*1050	0	33	5.56	1.7
*1050	0	67	4.87	1.5
*1050	0	133	.99	.31
*1050	0	200	.24	.75E-01
1030	199	0	2.37	.73
*1030	199	33	.22	.67E-01
*1030	199	100	.16	.50E-01
*1030	199	167	.23	.71E-01
*971	390	0	.07	.21E-01
2010	-398	0	1.22	.38
2040	-200	0	6.89	2.1
2050	0	0	9.22	2.8
*2050	0	50	3.10	.95
*2050	0	100	1.66	.51
*2050	0	200	.19	.57E-01
*2050	0	300	.01	.30E-02
2040	200	0	6.24	1.9
2010	398	0	.84	.26
3426	-399	0	1.47	.45
3444	-200	0	5.51	1.7
3450	0	0	7.52	2.3
*3450	0	67	.89	.27
*3450	0	200	.07	.21E-01
*3450	0	300	.09	.27E-01
*3450	0	400	.07	.20E-01
3444	200	0	5.83	1.8
3426	399	0	2.40	.74
5044	-232	0	4.68	1.4
5050	0	0	5.72	1.8
5050	0	67	1.33	.41
5050	0	200	.04	.13E-01
5050	0	300	.02	.54E-02
5050	0	400	.00	.12E-02
5044	232	0	4.84	1.5
6650	0	0	4.51	1.4

Table 10-21

RUN NUMBER 203

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	4
TIME EQUIVALENT	120	270 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		420 LBM/SEC	FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	6.24	3.3
365	-163	0	3.57	1.9
400	0	0	.89	.47
365	163	0	2.49	1.3
267	298	0	2.77	1.4
921	-390	0	1.46	.76
980	-199	0	1.07	.56
1000	0	0	.38	.20
980	199	0	.44	.23
921	390	0	1.01	.53
1960	-398	0	.72	.38
1990	-200	0	.38	.20
2000	0	0	.27	.14
1990	200	0	.27	.14
1960	398	0	.27	.14
2000	0	17	.21	.11
2000	0	33	.06	.31E-01
2000	0	67	0.00	0.
2000	0	133	.04	.22E-01
2000	0	200	.01	.74E-02
3376	-399	0	0.00	0.
3394	-200	0	.13	.67E-01
3400	0	0	0.00	0.
3394	200	0	.22	.12
3376	399	0	.14	.73E-01
4984	-400	0	.09	.49E-01
4996	-200	0	.11	.58E-01
5000	0	0	.06	.31E-01
4996	200	0	.13	.67E-01
4984	400	0	.13	.70E-01
6600	0	0	.12	.64E-01
0	0	0	0.00	0.

Table 10-22

RUN NUMBER 303

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	4
TIME EQUIVALENT	120	270 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		420 LBM/SEC	FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	.11	.85E-01
365	-163	0	2.97	2.3
400	0	0	1.13	.87
365	163	0	1.39	1.1
267	298	0	.16	.12
921	-390	0	.35	.27
980	-199	0	.92	.70
1000	0	0	.50	.38
980	199	0	.50	.38
921	390	0	.15	.12
1960	-398	0	.44	.33
1990	-200	0	.36	.28
2000	0	0	.24	.18
1990	200	0	.24	.19
1960	398	0	.31	.24
2000	0	17	.19	.14
2000	0	33	.14	.11
2000	0	67	.12	.89E-01
2000	0	133	.08	.64E-01
2000	0	200	.04	.32E-01
3376	-399	0	.23	.18
3394	-200	0	.19	.14
3400	0	0	.15	.11
3394	200	0	.17	.13
3376	399	0	.08	.60E-01
4984	-400	0	.08	.60E-01
4996	-200	0	.10	.76E-01
5000	0	0	.07	.52E-01
4996	200	0	.07	.52E-01
4984	400	0	.03	.24E-01
6600	0	0	.05	.36E-01
0	0	0	0.00	0.

Table 10-23

RUN NUMBER 303C

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	6
TIME EQUIVALENT	120	270 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		23.0 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	-160 C
BOIL OFF RATE		420 LBM/SEC	FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	13.03	10.0
415	-163	0	8.78	6.7
450	0	0	3.42	2.6
*450	0	33	1.85	1.4
*450	0	67	1.23	.94
*450	0	133	.39	.30
*450	0	200	.02	.17E-01
415	163	0	1.50	1.1
317	298	0	.31	.24
*971	-390	0	3.67	2.8
1030	-199	0	2.58	2.0
*1030	-199	33	1.94	1.5
*1030	-199	100	.10	.79E-01
*1030	-199	167	.03	.25E-01
*1050	0	0	1.39	1.1
*1050	0	33	.90	.69
*1050	0	67	.73	.56
*1050	0	133	.25	.19
*1050	0	200	.03	.24E-01
1030	199	0	.92	.70
*1030	199	33	.26	.20
*1030	199	100	.06	.48E-01
*1030	199	167	.01	.77E-02
*971	390	0	.25	.19
2010	-398	0	1.60	1.2
2040	-200	0	1.46	1.1
2050	0	0	.91	.70
*2050	0	50	.71	.55
*2050	0	100	.41	.31
*2050	0	200	.08	.58E-01
*2050	0	300	.00	.22E-02
2040	200	0	.79	.60
2010	398	0	.12	.94E-01
3426	-399	0	1.25	.96
3444	-200	0	.72	.55
3450	0	0	1.00	.76
*3450	0	67	.60	.46
*3450	0	200	.09	.65E-01
*3450	0	300	.01	.80E-02
*3450	0	400	.00	.22E-02
3444	200	0	.31	.24
3426	399	0	.16	.12
5044	-232	0	.61	.46
5050	0	0	.69	.53
5050	0	67	.47	.36
5050	0	200	.09	.66E-01
5050	0	300	.02	.15E-01
5050	0	400	.01	.40E-02
5044	232	0	.19	.14
6650	0	0	.46	.35

Table 10-24

RUN NUMBER 23

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	9
TIME EQUIVALENT	120	270 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		0	STRATIFICATION	23 C
WIND SPEED		9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		420 LBM/SEC	FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	3.60	.74
415	-163	0	6.66	1.4
450	0	0	15.16	3.1
415	163	0	17.44	3.6
317	298	0	10.66	2.2
971	-390	0	.49	.10
1030	-199	0	.34	.70E-01
1050	0	0	.31	.64E-01
1030	199	0	.30	.62E-01
971	390	0	.46	.94E-01
2010	-398	0	.07	.14E-01
2040	-200	0	.04	.90E-02
2050	0	0	.06	.12E-01
2040	200	0	.08	.16E-01
2010	398	0	.11	.22E-01
2050	0	17	.11	.23E-01
2050	0	33	.30	.62E-01
2050	0	67	.41	.85E-01
2050	0	133	.15	.31E-01
2050	0	200	.07	.14E-01
3426	-399	0	.04	.90E-02
3444	-200	0	.09	.18E-01
3450	0	0	.13	.26E-01
3444	200	0	.13	.27E-01
3426	399	0	.05	.11E-01
5034	-400	0	.05	.10E-01
5046	-200	0	.06	.12E-01
5050	0	0	.04	.90E-02
5046	200	0	.07	.15E-01
5034	400	0	.10	.20E-01
6650	0	0	.07	.14E-01
0	0	0	0.00	0.

Table 10-25

RUN NUMBER 23C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		HIGH
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	120	270 SEC
WIND DIRECTION		0
WIND SPEED		9.8 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		420 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	10
WIND SPEED	.71 FT/S
STRATIFICATION	25 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-160 C
FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	20.16	4.2
415	-163	0	18.81	3.9
450	0	0	20.86	4.3
415	163	0	12.20	2.5
317	298	0	4.57	.94
1030	-199	0	6.55	1.3
1030	199	0	9.73	2.0
2010	-398	0	1.67	.34
2040	-200	0	5.89	1.2
2050	0	0	11.60	2.4
2040	200	0	11.28	2.3
2010	398	0	3.17	.65
3426	-399	0	1.12	.23
3444	-200	0	2.43	.50
3450	0	0	4.85	1.00
3444	200	0	4.67	.96
3426	399	0	3.17	.65
5044	-232	0	2.26	.47
5050	0	0	2.63	.54
5050	0	67	1.55	.32
5050	0	200	.08	.16E-01
5050	0	300	.11	.23E-01
5050	0	400	.01	.28E-02
5044	232	0	3.18	.66
6650	0	0	2.54	.52

Table 10-26

RUN NUMBER 223

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	9
TIME EQUIVALENT	120	270 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION		0	STRATIFICATION	24 C
WIND SPEED		16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		420 LBM/SEC	FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	6.25	2.1
415	-163	0	7.31	2.5
450	0	0	12.88	4.3
415	163	0	15.62	5.3
317	298	0	15.09	5.1
971	-390	0	.22	.74E-01
1030	-199	0	.25	.85E-01
1050	0	0	.30	.10
1030	199	0	.44	.15
971	390	0	.66	.22
2010	-398	0	.12	.39E-01
2040	-200	0	.11	.39E-01
2050	0	0	.14	.48E-01
2040	200	0	.15	.50E-01
2010	398	0	.20	.68E-01
2050	0	17	.18	.61E-01
2050	0	33	.48	.16
2050	0	67	.47	.16
2050	0	133	.13	.44E-01
2050	0	200	.06	.19E-01
3426	-399	0	.09	.31E-01
3444	-200	0	.22	.73E-01
3450	0	0	.23	.78E-01
3444	200	0	.26	.89E-01
3426	399	0	.12	.40E-01
5034	-400	0	.04	.13E-01
5046	-200	0	.06	.20E-01
5050	0	0	.04	.13E-01
5046	200	0	.12	.39E-01
5034	400	0	.08	.28E-01
6650	0	0	.01	.41E-02
0	0	0	0.00	0.

Table 10-27

RUN NUMBER 323

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	9
TIME EQUIVALENT	120	270 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION		0	STRATIFICATION	24 C
WIND SPEED		23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		420 LBM/SEC	FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	9.74	4.6
415	-163	0	14.49	6.8
450	0	0	12.32	5.8
415	163	0	11.76	5.5
317	298	0	13.30	6.3
971	-390	0	.24	.12
1030	-199	0	.32	.15
1050	0	0	.36	.17
1030	199	0	.41	.20
971	390	0	.47	.22
2010	-398	0	.15	.72E-01
2040	-200	0	.15	.69E-01
2050	0	0	.17	.79E-01
2040	200	0	.20	.96E-01
2010	398	0	.26	.12
2050	0	17	.22	.10
2050	0	33	.38	.18
2050	0	67	.28	.13
2050	0	133	.08	.38E-01
2050	0	200	.02	.11E-01
3426	-399	0	.10	.45E-01
3444	-200	0	.17	.79E-01
3450	0	0	.19	.91E-01
3444	200	0	.25	.12
3426	399	0	.07	.33E-01
5034	-400	0	.09	.40E-01
5046	-200	0	.10	.47E-01
5050	0	0	.09	.42E-01
5046	200	0	.17	.81E-01
5034	400	0	.19	.88E-01
6650	0	0	.04	.18E-01
0	0	0	0.00	0.

Table 10-28

RUN NUMBER 323C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		HIGH
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	120	270 SEC
WIND DIRECTION		0
WIND SPEED		23.0 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		420 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	10
WIND SPEED	1.62 FT/S
STRATIFICATION	26 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-160 C
FLOW RATE	.43 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	13.10	6.2
415	-163	0	5.59	2.6
450	0	0	10.20	4.8
415	163	0	15.72	7.4
317	298	0	16.18	7.6
1030	-199	0	5.31	2.5
1030	199	0	12.32	5.8
2010	-398	0	1.48	.70
2040	-200	0	1.52	.71
2050	0	0	2.98	1.4
2040	200	0	9.11	4.3
2010	398	0	4.27	2.0
3426	-399	0	.91	.43
3444	-200	0	1.09	.51
3450	0	0	1.40	.66
3444	200	0	4.11	1.9
3426	399	0	3.37	1.6
5044	-232	0	.74	.35
5050	0	0	1.98	.93
5050	0	67	.62	.29
5050	0	200	.03	.16E-01
5050	0	300	.00	.66E-03
5050	0	400	.00	.40E-03
5044	232	0	2.89	1.4
6650	0	0	.79	.37

Table 10-29

RUN NUMBER

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	HIGH
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	0
WIND SPEED	9.8 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	160 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	2
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	1.74	1.4
270	-130	0	2.37	2.0
300	0	0	.36	.30
270	130	0	2.63	2.2
187	234	0	.68	.56
702	-384	0	.15	.12
775	-198	0	.49	.40
800	0	0	.42	.35
775	198	0	.41	.33
702	384	0	.13	.10
1343	-395	0	.14	.12
1386	-200	0	.20	.17
1400	0	0	.32	.26
1386	200	0	.16	.13
1343	395	0	.09	.78E-01
2367	-398	0	.09	.78E-01
2392	-200	0	.20	.16
2400	0	0	.17	.14
2392	200	0	.03	.26E-01
2367	398	0	.11	.89E-01
3578	-399	0	.13	.11
3594	-200	0	.17	.14
3600	0	0	.14	.12
3594	200	0	.13	.11
3578	399	0	.11	.94E-01
4984	-400	0	.08	.68E-01
4996	-200	0	.13	.11
5000	0	0	.09	.78E-01
4996	200	0	.09	.78E-01
4984	400	0	.10	.84E-01
6000	0	0	.11	.94E-01
0	0	0	0.00	0.

Table 10-30

RUN NUMBER 4V

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	HIGH
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	0
WIND SPEED	9.8 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	160 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	5
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	.31	.26
450	0	17	.23	.19
450	0	33	.06	.47E-01
450	0	67	.05	.38E-01
450	0	133	.04	.33E-01
450	0	200	.03	.23E-01
1023	-232	0	.12	.10
1023	-232	33	.09	.75E-01
1023	-232	100	.05	.38E-01
1023	-232	167	.04	.33E-01
1050	0	0	.26	.22
1050	0	17	.15	.13
1050	0	33	.08	.66E-01
1050	0	67	.06	.52E-01
1050	0	133	.03	.23E-01
1050	0	200	.02	.14E-01
1023	232	0	.14	.12
1023	232	33	.13	.11
1023	232	100	.18	.15
1023	232	167	.03	.23E-01
2050	0	0	.11	.94E-01
3450	0	0	.09	.70E-01
3450	0	67	.06	.47E-01
3450	0	200	.05	.42E-01
3450	0	300	.10	.85E-01
3450	0	400	.01	.94E-02
5050	0	0	.07	.56E-01
5050	0	67	.03	.28E-01
5050	0	200	.02	.19E-01
5050	0	300	.01	.47E-02
5050	0	400	0.00	0.
6650	0	0	.03	.23E-01

Table 10-31

RUN NUMBER 4A

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	1
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
165	-230	0	6.14	5.1
252	-130	0	2.70	2.2
283	0	0	1.14	.94
252	130	0	2.66	2.2
165	230	0	4.80	4.0
490	-373	0	3.41	2.8
584	-197	0	1.59	1.3
617	0	0	5.89	4.9
584	197	0	4.64	3.8
490	373	0	.25	.21
1134	-393	0	1.30	1.1
1183	-199	0	.55	.45
1200	0	0	.25	.21
1183	199	0	.55	.45
1134	393	0	.48	.39
2569	-399	0	.36	.30
2592	-200	0	.13	.11
2600	0	0	.13	.11
2592	200	0	.13	.11
2569	399	0	.12	.98E-01
3913	-399	0	.10	.79E-01
3928	-200	0	.09	.77E-01
3933	0	0	.10	.79E-01
3928	200	0	0.00	0.
3913	399	0	0.00	0.
5235	-400	0	0.00	0.
5246	-200	0	0.00	0.
5250	0	0	0.00	0.
5246	200	0	0.00	0.
5235	400	0	0.00	0.
0	0	0	0.00	0.
0	0	0	0.00	0.

Table 10-32

RUN NUMBER 4C

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	6
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	4 C
WIND SPEED	9.8 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	-146 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	6.66	5.5
415	-163	0	6.76	5.6
450	0	0	2.92	2.4
*450	0	33	1.29	1.1
*450	0	67	.21	.17
*450	0	133	.04	.35E-01
*450	0	200	.03	.24E-01
415	163	0	1.71	1.4
317	298	0	.38	.31
*971	-390	0	3.62	3.0
1030	-199	0	3.29	2.7
*1030	-199	33	2.10	1.7
*1030	-199	100	.01	.12E-01
*1030	-199	167	.04	.35E-01
*1050	0	0	.94	.77
*1050	0	33	1.48	1.2
*1050	0	67	.48	.39
*1050	0	133	.04	.32E-01
*1050	0	200	.03	.23E-01
1030	199	0	.47	.39
*1030	199	33	.14	.11
*1030	199	100	.04	.37E-01
*1030	199	167	.01	.59E-02
*971	390	0	.08	.64E-01
2010	-398	0	1.62	1.3
2040	-200	0	2.07	1.7
2050	0	0	.68	.56
*2050	0	50	.33	.28
*2050	0	100	.06	.51E-01
*2050	0	200	.02	.15E-01
*2050	0	300	.00	.24E-02
2040	200	0	.41	.34
2010	398	0	.08	.68E-01
3426	-399	0	1.96	1.6
3444	-200	0	1.08	.90
3450	0	0	1.15	.95
*3450	0	67	.11	.88E-01
*3450	0	200	.01	.43E-02
*3450	0	300	.01	.73E-02
*3450	0	400	.02	.14E-01
3444	200	0	.31	.26
3426	399	0	.08	.70E-01
5044	-232	0	.87	.72
5050	0	0	1.01	.83
5050	0	67	.16	.13
5050	0	200	.01	.78E-02
5050	0	300	.02	.15E-01
5050	0	400	.01	.47E-02
5044	232	0	.24	.20
6650	0	0	.72	.59

Table 10-33

RUN NUMBER 204

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	4
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	.01	.75E-02
365	-163	0	2.28	3.2
400	0	0	.68	.96
365	163	0	.63	.88
267	298	0	.07	.97E-01
921	-390	0	.04	.60E-01
980	-199	0	.57	.81
1000	0	0	.23	.33
980	199	0	.16	.23
921	390	0	.17	.24
1960	-398	0	.15	.22
1990	-200	0	.16	.23
2000	0	0	.11	.15
1990	200	0	.07	.10
1960	398	0	.08	.11
2000	0	17	.07	.10
2000	0	33	.05	.75E-01
2000	0	67	.03	.37E-01
2000	0	133	.01	.15E-01
2000	0	200	.02	.22E-01
3376	-399	0	.10	.13
3394	-200	0	.06	.90E-01
3400	0	0	.04	.60E-01
3394	200	0	.04	.52E-01
3376	399	0	.02	.30E-01
4984	-400	0	.01	.15E-01
4996	-200	0	.06	.82E-01
5000	0	0	.02	.30E-01
4996	200	0	.02	.30E-01
4984	400	0	.02	.30E-01
6600	0	0	.03	.37E-01
0	0	0	0.00	0.

Table 10-34

RUN NUMBER 304

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	HIGH
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	0
WIND SPEED	23.0 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	160 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	4
WIND SPEED	1.62 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	.01	.22E-01
365	-163	0	1.39	2.9
400	0	0	.61	1.2
365	163	0	.36	.75
267	298	0	.09	.18
921	-390	0	.01	.11E-01
980	-199	0	.30	.62
1000	0	0	.18	.38
980	199	0	.18	.38
921	390	0	.02	.43E-01
1960	-398	0	.05	.11
1990	-200	0	.12	.25
2000	0	0	.09	.19
1990	200	0	.10	.21
1960	398	0	.09	.18
2000	0	17	.08	.17
2000	0	33	.06	.13
2000	0	67	.06	.12
2000	0	133	.05	.97E-01
2000	0	200	.01	.22E-01
3376	-399	0	.06	.12
3394	-200	0	.05	.11
3400	0	0	.05	.97E-01
3394	200	0	.06	.12
3376	399	0	.03	.54E-01
4984	-400	0	.01	.22E-01
4996	-200	0	.03	.54E-01
5000	0	0	.01	.22E-01
4996	200	0	.01	.22E-01
4984	400	0	.02	.32E-01
6600	0	0	.02	.32E-01
0	0	0	0.00	0.

Table 10-35

RUN NUMBER 304V

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	5
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	.06	.12
450	0	17	.06	.12
450	0	33	.02	.35E-01
450	0	67	.03	.53E-01
450	0	133	.03	.55E-01
450	0	200	0.00	0.
1023	-232	0	.05	.95E-01
1023	-232	33	.03	.51E-01
1023	-232	100	.01	.19E-01
1023	-232	167	.01	.19E-01
1050	0	0	.01	.26E-01
1050	0	17	.02	.48E-01
1050	0	33	.01	.14E-01
1050	0	67	.02	.37E-01
1050	0	133	.01	.11E-01
1050	0	200	.01	.14E-01
1023	232	0	.04	.72E-01
1023	232	33	.04	.81E-01
1023	232	100	.15	.32
1023	232	167	.01	.14E-01
2050	0	0	.02	.48E-01
3450	0	0	.02	.34E-01
3450	0	67	.02	.39E-01
3450	0	200	.01	.26E-01
3450	0	300	.02	.40E-01
3450	0	400	0.00	0.
5050	0	0	.02	.33E-01
5050	0	67	.00	.93E-02
5050	0	200	.00	.93E-02
5050	0	300	.00	.47E-02
5050	0	400	.01	.27E-01
6650	0	0	0.00	0.

Table 10-36

RUN NUMBER 304C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	HIGH
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	0
WIND SPEED	23.0 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	160 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	6
WIND SPEED	1.62 FT/S
STRATIFICATION	2 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-141 C
FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	3.01	6.2
415	-163	0	3.10	6.4
450	0	0	.32	.66
*450	0	33	.58	1.2
*450	0	67	.20	.41
*450	0	133	.03	.71E-01
*450	0	200	.01	.17E-01
415	163	0	.38	.77
317	298	0	.12	.24
*971	-390	0	1.31	2.7
1030	-199	0	.75	1.5
*1030	-199	33	.32	.65
*1030	-199	100	.01	.23E-01
*1030	-199	167	.01	.19E-01
*1050	0	0	.34	.71
*1050	0	33	.19	.40
*1050	0	67	.11	.24
*1050	0	133	.03	.63E-01
*1050	0	200	.01	.11E-01
1030	199	0	.13	.27
*1030	199	33	.07	.15
*1030	199	100	.01	.21E-01
*1030	199	167	0.00	0.
*971	390	0	.17	.35
2010	-398	0	.70	1.4
2040	-200	0	.46	.95
2050	0	0	.16	.33
*2050	0	50	.15	.30
*2050	0	100	.05	.11
*2050	0	200	.01	.14E-01
*2050	0	300	.00	.86E-03
2040	200	0	.09	.18
2010	398	0	.04	.77E-01
3426	-399	0	.44	.91
3444	-200	0	.23	.48
3450	0	0	.13	.27
*3450	0	67	.10	.21
*3450	0	200	.01	.15E-01
*3450	0	300	.00	.17E-02
*3450	0	400	.00	.97E-03
3444	200	0	.06	.13
3426	399	0	.04	.90E-01
5044	-232	0	.18	.37
5050	0	0	.11	.23
5050	0	67	.05	.11
5050	0	200	.01	.21E-01
5050	0	300	0.00	0.
5050	0	400	.01	.15E-01
5044	232	0	.05	.10
6650	0	0	.08	.16

Table 10-37

RUN NUMBER 24

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	HIGH
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	0
WIND SPEED	9.8 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	160 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	9
WIND SPEED	.71 FT/S
STRATIFICATION	23 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	.13	.73E-01
415	-163	0	.18	.10
450	0	0	.38	.21
415	163	0	7.79	4.3
317	298	0	7.40	4.1
971	-390	0	.11	.58E-01
1030	-199	0	.06	.31E-01
1050	0	0	.08	.43E-01
1030	199	0	.09	.49E-01
971	390	0	.13	.73E-01
2010	-398	0	.03	.15E-01
2040	-200	0	.04	.22E-01
2050	0	0	.04	.25E-01
2040	200	0	.05	.27E-01
2010	398	0	.04	.20E-01
2050	0	17	.05	.25E-01
2050	0	33	.10	.58E-01
2050	0	67	.14	.80E-01
2050	0	133	.04	.19E-01
2050	0	200	0.00	0.
3426	-399	0	.01	.66E-02
3444	-200	0	.03	.19E-01
3450	0	0	.06	.31E-01
3444	200	0	.06	.31E-01
3426	399	0	.01	.63E-02
5034	-400	0	.02	.10E-01
5046	-200	0	.02	.10E-01
5050	0	0	.03	.18E-01
5046	200	0	.05	.25E-01
5034	400	0	.04	.25E-01
6650	0	0	.03	.18E-01
0	0	0	0.00	0.

Table 10-38

RUN NUMBER 24V

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	5
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	22 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	5.67	3.1
450	0	17	.78	.43
450	0	33	.14	.77E-01
450	0	67	.18	.10E+00
450	0	133	.14	.79E-01
450	0	200	.05	.30E-01
1023	-232	0	.14	.80E-01
1023	-232	33	.21	.11
1023	-232	100	.10	.53E-01
1023	-232	167	.04	.22E-01
1050	0	0	.17	.92E-01
1050	0	17	.14	.80E-01
1050	0	33	.16	.86E-01
1050	0	67	.11	.63E-01
1050	0	133	.11	.60E-01
1050	0	200	.04	.23E-01
1023	232	0	.13	.71E-01
1023	232	33	.19	.11
1023	232	100	.14	.75E-01
1023	232	167	.03	.17E-01
2050	0	0	.06	.35E-01
3450	0	0	.03	.18E-01
3450	0	67	.05	.26E-01
3450	0	200	.02	.13E-01
3450	0	300	.04	.21E-01
3450	0	400	.01	.35E-02
5050	0	0	.01	.38E-02
5050	0	67	.00	.22E-02
5050	0	200	.01	.79E-02
5050	0	300	.01	.52E-02
5050	0	400	.01	.65E-02
6650	0	0	0.00	0.

Table 10-39

RUN NUMBER 24C

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	10
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	25 C
WIND SPEED	9.8 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	-137 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	13.56	7.5
415	-163	0	14.54	8.1
450	0	0	7.53	4.2
415	163	0	3.15	1.7
317	298	0	1.61	.89
1030	-199	0	5.23	2.9
1030	199	0	1.62	.90
2010	-398	0	1.89	1.0
2040	-200	0	2.11	1.2
2050	0	0	2.36	1.3
2040	200	0	2.55	1.4
2010	398	0	1.05	.58
3426	-399	0	1.11	.62
3444	-200	0	1.06	.59
3450	0	0	1.62	.90
3444	200	0	1.42	.79
3426	399	0	.82	.45
5044	-232	0	.83	.46
5050	0	0	.81	.45
5050	0	67	1.28	.71
5050	0	200	.03	.16E-01
5050	0	300	.04	.21E-01
5050	0	400	.01	.49E-02
5044	232	0	.84	.47
6650	0	0	.40	.22

Table 10-40

RUN NUMBER 224

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	9
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION	0	STRATIFICATION	24 C
WIND SPEED	16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	.14	.13
415	-163	0	.21	.19
450	0	0	.28	.25
415	163	0	2.13	1.9
317	298	0	3.32	3.0
971	-390	0	.12	.10
1030	-199	0	.11	.10
1050	0	0	.13	.11
1030	199	0	.18	.17
971	390	0	.26	.23
2010	-398	0	.04	.38E-01
2040	-200	0	.05	.46E-01
2050	0	0	.06	.50E-01
2040	200	0	.06	.55E-01
2010	398	0	.07	.65E-01
2050	0	17	.07	.67E-01
2050	0	33	.13	.12
2050	0	67	.14	.13
2050	0	133	0.00	0.
2050	0	200	.01	.52E-02
3426	-399	0	.04	.37E-01
3444	-200	0	.08	.76E-01
3450	0	0	.10	.90E-01
3444	200	0	.10	.88E-01
3426	399	0	.04	.36E-01
5034	-400	0	.02	.20E-01
5046	-200	0	.03	.25E-01
5050	0	0	.02	.19E-01
5046	200	0	.05	.46E-01
5034	400	0	.03	.29E-01
6650	0	0	0.00	0.
0	0	0	0.00	0.

Table 10-41

RUN NUMBER 324

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	9
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	0	STRATIFICATION	25 C
WIND SPEED	23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	.04	.46E-01
415	-163	0	.08	.10
450	0	0	.34	.43
415	163	0	.85	1.1
317	298	0	1.19	1.5
971	-390	0	.09	.11
1030	-199	0	.10	.12
1050	0	0	.12	.15
1030	199	0	.14	.18
971	390	0	.10	.13
2010	-398	0	.04	.46E-01
2040	-200	0	.06	.78E-01
2050	0	0	.07	.85E-01
2040	200	0	.08	.98E-01
2010	398	0	.09	.12
2050	0	17	.12	.16
2050	0	33	.11	.14
2050	0	67	.08	.98E-01
2050	0	133	.01	.65E-02
2050	0	200	.01	.13E-01
3426	-399	0	.01	.13E-01
3444	-200	0	.08	.98E-01
3450	0	0	.09	.11
3444	200	0	.10	.12
3426	399	0	.02	.26E-01
5034	-400	0	.02	.20E-01
5046	-200	0	.06	.78E-01
5050	0	0	.06	.72E-01
5046	200	0	.08	.10
5034	400	0	.05	.65E-01
6650	0	0	.03	.39E-01
0	0	0	0.00	0.

Table 10-42

RUN NUMBER 324V

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	5
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	0	STRATIFICATION	23 C
WIND SPEED	23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	160 LBM/SEC	FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	4.01	5.1
450	0	17	1.79	2.3
450	0	33	.36	.46
450	0	67	.35	.44
450	0	133	.11	.13
450	0	200	.02	.22E-01
1023	-232	0	.14	.18
1023	-232	33	.17	.21
1023	-232	100	.11	.14
1023	-232	167	.03	.37E-01
1050	0	0	.15	.19
1050	0	17	.16	.20
1050	0	33	.15	.19
1050	0	67	.14	.17
1050	0	133	.12	.16
1050	0	200	.02	.21E-01
1023	232	0	.13	.17
1023	232	33	.21	.27
1023	232	100	.22	.27
1023	232	167	.00	.31E-02
2050	0	0	.07	.88E-01
3450	0	0	.04	.47E-01
3450	0	67	.07	.85E-01
3450	0	200	.03	.32E-01
3450	0	300	.01	.11E-01
3450	0	400	.01	.10E-01
5050	0	0	.04	.45E-01
5050	0	67	.04	.45E-01
5050	0	200	.01	.16E-01
5050	0	300	.02	.24E-01
5050	0	400	.02	.21E-01
6650	0	0	0.00	0.

Table 10-43

RUN NUMBER 324C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	HIGH
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	0
WIND SPEED	23.0 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	160 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	10
WIND SPEED	1.62 FT/S
STRATIFICATION	26 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-146 C
FLOW RATE	.16 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	1.37	1.7
415	-163	0	.38	.46
450	0	0	.77	.98
415	163	0	.26	.32
317	298	0	.32	.41
1030	-199	0	.75	.95
1030	199	0	.29	.36
2010	-398	0	.17	.22
2040	-200	0	.23	.29
2050	0	0	.17	.21
2040	200	0	.19	.24
2010	398	0	.07	.84E-01
3426	-399	0	.05	.67E-01
3444	-200	0	.10	.12
3450	0	0	.06	.76E-01
3444	200	0	.09	.12
3426	399	0	.04	.55E-01
5044	-232	0	.05	.57E-01
5050	0	0	.04	.50E-01
5050	0	67	.00	.60E-02
5050	0	200	.00	.46E-02
5050	0	300	0.00	0.
5050	0	400	.00	.42E-02
5044	232	0	.04	.47E-01
6650	0	0	.01	.18E-01

Table 10-44

RUN NUMBER 5

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	HIGH	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	2
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	29 LBM/SEC	FLOW RATE	.03 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	.08	.35
270	-130	0	.09	.43
300	0	0	.03	.14
270	130	0	.04	.20
187	234	0	.08	.35
702	-384	0	.05	.23
775	-198	0	.08	.38
800	0	0	.08	.35
775	198	0	.03	.14
702	384	0	.08	.35
1343	-395	0	.04	.20
1386	-200	0	.03	.14
1400	0	0	.03	.14
1386	200	0	.05	.23
1343	395	0	.05	.23
2367	-398	0	.05	.23
2392	-200	0	.08	.35
2400	0	0	.08	.35
2392	200	0	0.00	0.
2367	398	0	.03	.14
3578	-399	0	.05	.23
3594	-200	0	.08	.35
3600	0	0	.08	.35
3594	200	0	.06	.26
3578	399	0	.03	.12
4984	-400	0	.02	.87E-01
4996	-200	0	.03	.14
5000	0	0	.03	.12
4996	200	0	.01	.58E-01
4984	400	0	.03	.12
6000	0	0	.03	.14
0	0	0	0.00	0.

Table 10-45

RUN NUMBER 10

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL		SOIL CONCRETE
TIME EQUIVALENT	1-120	.08 SEC
WIND DIRECTION		0
WIND SPEED		9.8 FT/S
STRATIFICATION		NEUTRAL
BOIL OFF RATE		2534 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	2
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	2.60 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	51.29	2.3
270	-130	0	60.03	2.7
300	0	0	50.22	2.2
270	130	0	12.48	.56
187	234	0	54.37	2.4
702	-384	0	36.51	1.6
775	-198	0	30.28	1.4
800	0	0	40.72	1.8
775	198	0	25.82	1.2
702	384	0	25.31	1.1
1343	-395	0	22.30	1.00
1386	-200	0	27.83	1.2
1400	0	0	26.95	1.2
1386	200	0	19.59	.88
1343	395	0	16.19	.72
2367	-398	0	14.81	.66
2392	-200	0	15.19	.68
2400	0	0	15.69	.70
2392	200	0	15.38	.69
2367	398	0	11.48	.51
3578	-399	0	12.61	.56
3594	-200	0	12.61	.56
3600	0	0	10.47	.47
3594	200	0	12.04	.54
3578	399	0	3.93	.18
4984	-400	0	6.38	.29
4996	-200	0	7.96	.36
5000	0	0	6.19	.28
4996	200	0	8.40	.38
4984	400	0	7.45	.33
6000	0	0	6.51	.29
0	0	0	0.00	0.

Table 10-46

RUN NUMBER 110

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL		SOIL CONCRETE
TIME EQUIVALENT	1-120	.08 SEC
WIND DIRECTION		0
WIND SPEED		9.8 FT/S
STRATIFICATION		NEUTRAL
BOIL OFF RATE		2534 LBM/SEC

MODEL CONDITIONS

SCALE	1-666
GRID TYPE	8
WIND SPEED	.39 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.49 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
140	-651	0	36.41	.44
518	-419	0	36.31	.43
666	0	0	42.48	.51
518	419	0	28.60	.34
140	651	0	27.63	.33
1154	-1201	0	20.18	.24
1532	-653	0	20.59	.25
1665	0	0	24.88	.30
1532	653	0	20.23	.24
1154	1201	0	14.93	.18
2336	-1280	0	12.22	.15
2581	-661	0	12.73	.15
2664	0	0	14.67	.18
2581	661	0	11.10	.13
2336	1280	0	9.42	.11
4473	-1315	0	7.53	.90E-01
4614	-664	0	1.97	.24E-01
4662	0	0	6.41	.77E-01
4614	664	0	4.47	.54E-01
4473	1315	0	4.57	.55E-01
6527	-1324	0	1.26	.15E-01
6627	-665	0	4.32	.52E-01
6660	0	0	2.79	.33E-01
6627	665	0	1.05	.13E-01
6527	1324	0	.49	.59E-02
7881	-1326	0	0.00	0.
7964	-665	0	0.00	0.
7992	0	0	0.00	0.
7964	665	0	.11	.13E-02
7881	1326	0	.49	.59E-02
0	0	0	0.00	0.
0	0	0	0.00	0.

Table 10-47

RUN NUMBER 11

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	2
TIME EQUIVALENT	1	170 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		0	STRATIFICATION	0 C
WIND SPEED		9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		850 LBM/SEC	FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	29.53	4.3
270	-130	0	37.14	5.4
300	0	0	5.64	.83
270	130	0	25.44	3.7
187	234	0	23.21	3.5
702	-384	0	12.11	1.8
775	-198	0	8.21	1.2
800	0	0	3.74	.54
775	198	0	4.94	.72
702	384	0	7.52	1.1
1343	-395	0	5.69	.83
1386	-200	0	3.62	.53
1400	0	0	1.73	.25
1386	200	0	1.73	.25
1343	395	0	3.18	.46
2367	-398	0	4.18	.61
2392	-200	0	1.85	.27
2400	0	0	.95	.14
2392	200	0	.12	.17E-01
2367	398	0	1.14	.17
3576	-399	0	2.87	.42
3594	-200	0	2.43	.35
3600	0	0	1.07	.16
3594	200	0	1.02	.15
3578	399	0	1.30	.19
4984	-400	0	1.46	.21
4996	-200	0	1.74	.25
5000	0	0	.49	.71E-01
4996	200	0	1.06	.15
4984	400	0	.94	.14
6000	0	0	1.00	.15
0	0	0	0.00	0.

Table 10-48

RUN NUMBER 31V

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL CONCRETE	SOIL	GRID TYPE	5
TIME EQUIVALENT 1	170 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	22 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	850 LBM/SEC	FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	32.80	3.2
450	0	17	2.40	.23
450	0	33	.67	.66E-01
450	0	67	.84	.81E-01
450	0	133	.37	.36E-01
450	0	200	.17	.16E-01
1023	-232	0	.20	.19E-01
1023	-232	33	.45	.44E-01
1023	-232	100	.18	.18E-01
1023	-232	167	.06	.58E-02
1050	0	0	.22	.21E-01
1050	0	17	.27	.27E-01
1050	0	33	.72	.70E-01
1050	0	67	.60	.58E-01
1050	0	133	.34	.33E-01
1050	0	200	.18	.18E-01
1023	232	0	.34	.33E-01
1023	232	33	.92	.89E-01
1023	232	100	.60	.59E-01
1023	232	167	.35	.34E-01
2050	0	0	0.00	0.
3450	0	0	.28	.27E-01
3450	0	67	.17	.16E-01
3450	0	200	.15	.15E-01
3450	0	300	.02	.22E-02
3450	0	400	0.00	0.
5050	0	0	.08	.82E-02
5050	0	67	.15	.15E-01
5050	0	200	.15	.15E-01
5050	0	300	.06	.63E-02
5050	0	400	.03	.33E-02
6650	0	0	0.00	0.

Table 10-49

RUN NUMBER 331V

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL CONCRETE	SOIL
TIME EQUIVALENT 1	170 SEC
WIND DIRECTION	0
WIND SPEED	23.0 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	850 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	5
WIND SPEED	1.62 FT/S
STRATIFICATION	22 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	25.70	5.7
450	0	17	5.75	1.3
450	0	33	1.02	.23
450	0	67	.74	.17
450	0	133	.10	.23E-01
450	0	200	.56	.12
1023	-232	0	1.13	.25
1023	-232	33	1.33	.30
1023	-232	100	.77	.17
1023	-232	167	.24	.53E-01
1050	0	0	1.33	.30
1050	0	17	1.58	.35
1050	0	33	1.47	.33
1050	0	67	.91	.20
1050	0	133	.42	.94E-01
1050	0	200	.01	.16E-02
1023	232	0	1.17	.26
1023	232	33	1.11	.25
1023	232	100	.27	.60E-01
1023	232	167	.20	.46E-01
2050	0	0	.74	.16
3450	0	0	.68	.15
3450	0	67	.31	.70E-01
3450	0	200	.02	.41E-02
3450	0	300	0.00	0.
3450	0	400	0.00	0.
5050	0	0	.56	.12
5050	0	67	.29	.65E-01
5050	0	200	.05	.11E-01
5050	0	300	0.00	0.
5050	0	400	0.00	0.
6650	0	0	0.00	0.

Table 10-50

RUN NUMBER 12

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	2
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	275 LBM/SEC	FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	2.17	.90
270	-130	0	8.90	3.7
300	0	0	1.23	.51
270	130	0	7.20	3.0
187	234	0	.93	.39
702	-384	0	1.37	.57
775	-198	0	1.54	.64
800	0	0	.66	.27
775	198	0	1.03	.43
702	384	0	.31	.13
1343	-395	0	.84	.35
1386	-200	0	.52	.21
1400	0	0	.33	.14
1386	200	0	.40	.17
1343	395	0	.41	.17
2367	-398	0	.32	.13
2392	-200	0	.25	.10
2400	0	0	.27	.11
2392	200	0	.00	.16E-02
2367	398	0	.20	.83E-01
3578	-399	0	.15	.61E-01
3594	-200	0	.22	.90E-01
3600	0	0	.19	.78E-01
3594	200	0	.15	.64E-01
3578	399	0	.08	.35E-01
4984	-400	0	.11	.45E-01
4996	-200	0	.15	.64E-01
5000	0	0	.15	.61E-01
4996	200	0	.17	.70E-01
4984	400	0	.08	.32E-01
6000	0	0	.10	.41E-01
0	0	0	0.00	0.

Table 10-51

RUN NUMBER 13

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	2
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	116 LPM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	.15	.16
270	-130	0	2.18	2.3
300	0	0	.44	.47
270	130	0	1.35	1.4
187	234	0	.04	.40E-01
702	-384	0	.06	.60E-01
775	-198	0	.21	.22
800	0	0	.27	.29
775	198	0	.16	.17
702	384	0	.01	.67E-02
1343	-395	0	.03	.33E-01
1386	-200	0	.13	.14
1400	0	0	.19	.20
1386	200	0	.08	.80E-01
1343	395	0	0.00	0.
2367	-398	0	.02	.20E-01
2392	-200	0	.10	.11
2400	0	0	.09	.93E-01
2392	200	0	.10	.11
2367	398	0	.01	.13E-01
3578	-399	0	.04	.47E-01
3594	-200	0	.04	.47E-01
3600	0	0	.15	.16
3594	200	0	.04	.40E-01
3578	399	0	0.00	0.
4984	-400	0	.01	.67E-02
4996	-200	0	.01	.67E-02
5000	0	0	0.00	0.
4996	200	0	.01	.13E-01
4984	400	0	.01	.67E-02
6000	0	0	.10	.11
0	0	0	0.00	0.

Table 10-52

RUN NUMBER 33V

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	CONCRETE
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	0
WIND SPEED	9.8 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	116 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	5
WIND SPEED	.71 FT/S
STRATIFICATION	22 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	.13	.94E-01
450	0	17	.07	.48E-01
450	0	33	.11	.77E-01
450	0	67	.17	.12
450	0	133	.08	.56E-01
450	0	200	.05	.36E-01
1023	-232	0	.06	.44E-01
1023	-232	33	.04	.26E-01
1023	-232	100	.04	.30E-01
1023	-232	167	.04	.25E-01
1050	0	0	.05	.34E-01
1050	0	17	.02	.17E-01
1050	0	33	.05	.37E-01
1050	0	67	.07	.50E-01
1050	0	133	.05	.38E-01
1050	0	200	.06	.39E-01
1023	232	0	.06	.43E-01
1023	232	33	.11	.79E-01
1023	232	100	.05	.38E-01
1023	232	167	.05	.35E-01
2050	0	0	.03	.25E-01
3450	0	0	.04	.27E-01
3450	0	67	.09	.62E-01
3450	0	200	.02	.12E-01
3450	0	300	.01	.59E-02
3450	0	400	.01	.42E-02
5050	0	0	.00	.14E-02
5050	0	67	.00	.35E-02
5050	0	200	.02	.17E-01
5050	0	300	.01	.66E-02
5050	0	400	.01	.38E-02
6650	0	0	0.00	0.

Table 10-53

RUN NUMBER 333V

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	CONCRETE
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	0
WIND SPEED	23.0 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	116 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	5
WIND SPEED	1.62 FT/S
STRATIFICATION	23 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	1.07	1.7
450	0	17	.61	.99
450	0	33	.17	.27
450	0	67	.08	.12
450	0	133	.02	.27E-01
450	0	200	.01	.18E-01
1023	-232	0	.19	.30
1023	-232	33	.18	.30
1023	-232	100	.10	.15
1023	-232	167	.03	.46E-01
1050	0	0	.17	.28
1050	0	17	.20	.32
1050	0	33	.17	.27
1050	0	67	.08	.13
1050	0	133	.03	.56E-01
1050	0	200	.01	.14E-01
1023	232	0	.15	.24
1023	232	33	.09	.15
1023	232	100	.02	.36E-01
1023	232	167	.00	.56E-02
2050	0	0	.12	.20
3450	0	0	.06	.10E+00
3450	0	67	.05	.73E-01
3450	0	200	0.00	0.
3450	0	300	0.00	0.
3450	0	400	0.00	0.
5050	0	0	.02	.33E-01
5050	0	67	.00	.56E-02
5050	0	200	.01	.19E-01
5050	0	300	.00	.72E-02
5050	0	400	.00	.16E-02
6650	0	0	0.00	0.

Table 10-54

RUN NUMBER 14

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	SOIL CONCRETE	GRID TYPE	2
TIME EQUIVALENT G.T.10*5	G.T.10*5 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	0	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	94 LBM/SEC	FLOW RATE	.09 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	.15	.20
270	-130	0	2.17	2.8
300	0	0	.40	.51
270	130	0	1.42	1.8
187	234	0	.01	.81E-02
702	-384	0	.03	.33E-01
775	-198	0	.31	.40
800	0	0	.34	.44
775	198	0	.03	.33E-01
702	384	0	.09	.12
1343	-395	0	.02	.24E-01
1386	-200	0	.02	.24E-01
1400	0	0	.14	.18
1386	200	0	.10	.13
1343	395	0	.06	.73E-01
2367	-398	0	0.00	0.
2392	-200	0	.03	.33E-01
2400	0	0	.05	.65E-01
2392	200	0	.06	.81E-01
2367	398	0	.04	.57E-01
3578	-399	0	.04	.49E-01
3594	-200	0	.02	.24E-01
3600	0	0	.03	.41E-01
3594	200	0	.04	.57E-01
3578	399	0	.01	.81E-02
4984	-400	0	0.00	0.
4996	-200	0	0.00	0.
5000	0	0	.03	.41E-01
4996	200	0	.07	.89E-01
4984	400	0	.07	.89E-01
6000	0	0	.01	.81E-02
0	0	0	0.00	0.

Table 10-55

RUN NUMBER 15

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		LOW	SCALE	1-200
DIKE MATERIAL		SOIL CONCRETE	GRID TYPE	2
TIME EQUIVALENT	1-120	.08 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		45	STRATIFICATION	0 C
WIND SPEED		9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		2534 LBM/SEC	FLOW RATE	2.60 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	76.30	3.4
270	-130	0	49.08	2.2
300	0	0	20.41	.91
270	130	0	53.58	2.4
187	234	0	68.26	3.1
702	-384	0	53.07	2.4
775	-198	0	36.61	1.6
800	0	0	25.47	1.1
775	198	0	32.25	1.4
702	384	0	33.96	1.5
1343	-395	0	28.77	1.3
1386	-200	0	28.77	1.3
1400	0	0	27.12	1.2
1386	200	0	19.21	.86
1343	395	0	20.09	.90
2367	-398	0	18.26	.82
2392	-200	0	17.88	.80
2400	0	0	17.63	.79
2392	200	0	15.54	.70
2367	398	0	15.79	.71
3578	-399	0	16.11	.72
3594	-200	0	14.59	.65
3600	0	0	10.66	.48
3594	200	0	12.75	.57
3578	399	0	11.11	.50
4984	-400	0	9.40	.42
4996	-200	0	10.41	.47
5000	0	0	8.07	.36
4996	200	0	9.40	.42
4984	400	0	9.27	.41
6000	0	0	8.45	.38
0	0	0	0.00	0.

Table 10-56

RUN NUMBER 115

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL		SOIL CONCRETE
TIME EQUIVALENT	1-120	.08 SEC
WIND DIRECTION		45
WIND SPEED		9.8 FT/S
STRATIFICATION		NEUTRAL
BOIL OFF RATE		2534 LBM/SEC

MODEL CONDITIONS

SCALE	1-666
GRID TYPE	8
WIND SPEED	.39 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.49 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
140	-651	0	35.33	.42
518	-419	0	31.56	.38
666	0	0	17.12	.21
518	419	0	26.61	.32
140	651	0	29.21	.35
1154	-1201	0	16.76	.20
1532	-653	0	15.94	.19
1665	0	0	12.37	.15
1532	653	0	12.83	.15
1154	1201	0	10.03	.12
2336	-1280	0	10.18	.12
2581	-661	0	9.87	.12
2664	0	0	7.37	.88E-01
2581	661	0	6.25	.75E-01
2336	1280	0	5.08	.61E-01
4473	-1315	0	5.33	.64E-01
4614	-664	0	0.00	0.
4662	0	0	4.46	.53E-01
4614	664	0	2.27	.27E-01
4473	1315	0	2.32	.28E-01
6527	-1324	0	3.24	.39E-01
6627	-665	0	3.75	.45E-01
6660	0	0	3.04	.36E-01
6627	665	0	2.73	.33E-01
6527	1324	0	1.45	.17E-01
7881	-1326	0	1.40	.17E-01
7964	-665	0	2.12	.25E-01
7992	0	0	1.10	.13E-01
7964	665	0	2.07	.25E-01
7881	1326	0	1.71	.20E-01
0	0	0	0.00	0.
0	0	0	0.00	0.

Table 10-57

RUN NUMBER 335

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL CONCRETE .08	SOIL	GRID TYPE	9
TIME EQUIVALENT	1-120 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	45	STRATIFICATION	18 C
WIND SPEED	23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	2340 LBM/SEC	FLOW RATE	2.40 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	59.58	4.4
415	-163	0	49.69	3.7
450	0	0	36.82	2.7
415	163	0	53.69	4.0
317	298	0	44.87	3.3
971	-390	0	7.23	.54
1030	-199	0	8.66	.64
1050	0	0	8.92	.66
1030	199	0	7.74	.57
971	390	0	5.99	.44
2010	-398	0	1.64	.12
2040	-200	0	1.74	.13
2050	0	0	1.84	.14
2040	200	0	1.74	.13
2010	398	0	1.74	.13
2050	0	17	1.79	.13
2050	0	33	2.55	.19
2050	0	67	1.48	.11
2050	0	133	.28	.21E-01
2050	0	200	.10	.72E-02
3426	-399	0	1.43	.11
3444	-200	0	1.84	.14
3450	0	0	2.05	.15
3444	200	0	2.41	.18
3426	399	0	1.38	.10
5034	-400	0	.87	.64E-01
5046	-200	0	.97	.72E-01
5050	0	0	1.02	.76E-01
5046	200	0	1.53	.12
5034	400	0	1.53	.11
6650	0	0	1.38	.10
0	0	0	0.00	0.

Table 10-58

RUN NUMBER 16

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	2
TIME EQUIVALENT	1	170 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		45	STRATIFICATION	0 C
WIND SPEED		9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		850 LBM/SEC	FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	40.03	5.8
270	-130	0	15.60	2.3
300	0	0	6.36	.93
270	130	0	15.41	2.2
187	234	0	28.20	4.1
702	-384	0	14.84	2.2
775	-198	0	9.53	1.4
800	0	0	1.36	.20
775	198	0	4.08	.59
702	384	0	8.01	1.2
1343	-395	0	7.50	1.1
1386	-200	0	4.91	.71
1400	0	0	1.55	.23
1386	200	0	2.12	.31
1343	395	0	3.45	.50
2367	-398	0	2.56	.37
2392	-200	0	2.88	.42
2400	0	0	1.23	.18
2392	200	0	.79	.12
2367	398	0	.92	.13
3578	-399	0	2.88	.42
3594	-200	0	2.12	.31
3600	0	0	.85	.12
3594	200	0	3.39	.49
3578	399	0	3.32	.48
4984	-400	0	.92	.13
4996	-200	0	.98	.14
5000	0	0	.38	.55E-01
4996	200	0	.25	.37E-01
4984	400	0	.19	.28E-01
6000	0	0	.25	.36E-01
0	0	0	0.00	0.

Table 10-59

RUN NUMBER 16V

PROTOTYPE CONDITIONS				MODEL CONDITIONS	
DIKE CONFIGURATION		LOW		SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL		GRID TYPE	5
TIME EQUIVALENT	1	170	SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		45		STRATIFICATION	0 C
WIND SPEED		9.8	FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL		RELEASE GAS TEMP.	22 C
BOIL OFF RATE		850	LBM/SEC	FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	11.82	1.7
450	0	17	4.45	.65
450	0	33	.34	.50E-01
450	0	67	.17	.25E-01
450	0	133	.03	.40E-02
450	0	200	.02	.31E-02
1023	-232	0	9.95	1.4
1023	-232	33	4.32	.63
1023	-232	100	.11	.16E-01
1023	-232	167	.02	.25E-02
1050	0	0	8.76	1.3
1050	0	17	6.88	1.0
1050	0	33	4.32	.63
1050	0	67	.53	.77E-01
1050	0	133	.07	.99E-02
1050	0	200	.02	.30E-02
1023	232	0	7.51	1.1
1023	232	33	2.45	.36
1023	232	100	.77	.11
1023	232	167	.05	.79E-02
2050	0	0	4.78	.70
3450	0	0	2.62	.38
3450	0	67	1.03	.15
3450	0	200	.10	.15E-01
3450	0	300	.02	.35E-02
3450	0	400	.02	.25E-02
5050	0	0	.53	.78E-01
5050	0	67	.43	.62E-01
5050	0	200	.23	.34E-01
5050	0	300	.06	.93E-02
5050	0	[illegible]	.02	.29E-02
6650	0		.82	.12

Table 10-60

RUN NUMBER 16C

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL CONCRETE	SOIL	GRID TYPE	6
TIME EQUIVALENT 1	170 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	45	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	-175 C
BOIL OFF RATE	850 LBM/SEC	FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	11.53	1.7
415	-163	0	9.31	1.4
450	0	0	4.15	.60
*450	0	33	.16	.24E-01
*450	0	67	.09	.13E-01
*450	0	133	.03	.46E-02
*450	0	200	.06	.84E-02
415	163	0	8.94	1.3
317	298	0	7.77	1.1
*971	-390	0	8.65	1.3
1030	-199	0	4.83	.70
*1030	-199	33	4.78	.69
*1030	-199	100	.09	.12E-01
*1030	-199	167	.08	.11E-01
*1050	0	0	3.23	.47
*1050	0	33	2.89	.42
*1050	0	67	.58	.85E-01
*1050	0	133	.07	.99E-02
*1050	0	200	.05	.72E-02
1030	199	0	4.40	.64
*1030	199	33	.46	.66E-01
*1030	199	100	.02	.24E-02
*1030	199	167	.02	.26E-02
*971	390	0	6.14	.89
2010	-398	0	3.88	.56
2040	-200	0	2.71	.39
2050	0	0	1.68	.24
*2050	0	50	.88	.13
*2050	0	100	.12	.18E-01
*2050	0	200	.02	.26E-02
*2050	0	300	.01	.17E-02
2040	200	0	2.18	.32
2010	398	0	2.15	.31
3426	-399	0	2.47	.36
3444	-200	0	1.50	.22
3450	0	0	1.44	.21
*3450	0	67	.53	.77E-01
*3450	0	200	.27	.39E-01
*3450	0	300	.02	.26E-02
*3450	0	400	.04	.51E-02
3444	200	0	1.32	.19
3426	399	0	1.57	.23
5044	-232	0	1.03	.15
5050	0	0	1.00	.15
5050	0	67	.37	.53E-01
5050	0	200	.08	.12E-01
5050	0	300	.01	.16E-02
5050	0	400	.04	.56E-02
5044	232	0	0.00	0.
6650	0	0	.67	.97E-01

Table 10-61

RUN NUMBER 216

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	170 SEC
WIND DIRECTION		45
WIND SPEED		16.4 FT/S
STRATIFICATION		NEUTRAL
BOIL OFF RATE		850 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	4
WIND SPEED	1.16 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	21.56	5.3
365	-163	0	10.83	2.7
400	0	0	1.09	.27
365	163	0	8.62	2.1
267	298	0	5.14	1.3
921	-390	0	8.46	2.1
980	-199	0	2.98	.74
1000	0	0	.83	.20
980	199	0	1.41	.35
921	390	0	2.41	.59
1960	-398	0	3.88	.96
1990	-200	0	1.14	.28
2000	0	0	.32	.79E-01
1990	200	0	.32	.79E-01
1960	398	0	.83	.20
2000	0	17	.23	.57E-01
2000	0	33	.16	.40E-01
2000	0	67	.12	.29E-01
2000	0	133	.12	.30E-01
2000	0	200	.01	.13E-02
3376	-399	0	2.46	.61
3394	-200	0	1.09	.27
3400	0	0	.22	.55E-01
3394	200	0	.17	.43E-01
3376	399	0	0.00	0.
4984	-400	0	.72	.18
4996	-200	0	.77	.19
5000	0	0	.13	.32E-01
4996	200	0	.11	.27E-01
4984	400	0	.06	.14E-01
6600	0	0	.25	.61E-01
0	0	0	0.00	0.

Table 10-62

RUN NUMBER 316

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	4
TIME EQUIVALENT	1	170 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION		45	STRATIFICATION	0 C
WIND SPEED		23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		850 LBM/SEC	FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	2.46	.89
365	-163	0	2.98	1.1
400	0	0	1.62	.58
365	163	0	1.30	.47
267	298	0	.06	.23E-01
921	-390	0	.77	.28
980	-199	0	1.25	.45
1000	0	0	.67	.24
980	199	0	.77	.28
921	390	0	.09	.32E-01
1960	-398	0	.62	.22
1990	-200	0	.56	.20
2000	0	0	.38	.14
1990	200	0	.37	.13
1960	398	0	.18	.65E-01
2000	0	17	.36	.13
2000	0	33	.24	.86E-01
2000	0	67	.19	.69E-01
2000	0	133	.06	.23E-01
2000	0	200	0.00	0.
3376	-399	0	.39	.14
3394	-200	0	.32	.12
3400	0	0	.25	.91E-01
3394	200	0	.24	.88E-01
3376	399	0	.08	.30E-01
4984	-400	0	.07	.27E-01
4996	-200	0	.16	.59E-01
5000	0	0	.04	.13E-01
4996	200	0	.13	.46E-01
4984	400	0	.11	.38E-01
6600	0	0	.13	.46E-01
0	0	0	0.00	0.

Table 10-63

RUN NUMBER 316V

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	170 SEC
WIND DIRECTION		45
WIND SPEED		23.0 FT/S
STRATIFICATION		NEUTRAL
BOIL OFF RATE		850 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	5
WIND SPEED	1.62 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	1.19	.43
450	0	17	.89	.32
450	0	33	.50	.18
450	0	67	.53	.19
450	0	133	.04	.13E-01
450	0	200	0.00	0.
1023	-232	0	3.49	1.3
1023	-232	33	1.39	.50
1023	-232	100	.13	.47E-01
1023	-232	167	.02	.58E-02
1050	0	0	.65	.24
1050	0	17	.61	.22
1050	0	33	.47	.17
1050	0	67	.25	.91E-01
1050	0	133	.03	.92E-02
1050	0	200	.01	.18E-02
1023	232	0	1.70	.61
1023	232	33	.93	.34
1023	232	100	.87	.31
1023	232	167	.02	.68E-02
2050	0	0	.71	.26
3450	0	0	.96	.35
3450	0	67	.29	.10
3450	0	200	.05	.18E-01
3450	0	300	.08	.28E-01
3450	0	400	.02	.64E-02
5050	0	0	.95	.34
5050	0	67	.26	.95E-01
5050	0	200	.08	.30E-01
5050	0	300	.03	.11E-01
5050	0	400	.03	.94E-02
6650	0	0	.83	.30

Table 10-64

RUN NUMBER 316C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	170 SEC
WIND DIRECTION		45
WIND SPEED		23.0 FT/S
STRATIFICATION		NEUTRAL
BOIL OFF RATE		850 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	6
WIND SPEED	1.62 FT/S
STRATIFICATION	0 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-155 C
FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	14.07	5.1
415	-163	0	14.48	5.2
450	0	0	2.59	.94
*450	0	33	1.14	.41
*450	0	67	.11	.38E-01
*450	0	133	.01	.46E-02
*450	0	200	.06	.23E-01
415	163	0	10.82	3.9
317	298	0	9.12	3.3
*971	-390	0	3.48	1.3
1030	-199	0	2.44	.88
*1030	-199	33	.54	.20
*1030	-199	100	.24	.86E-01
*1030	-199	167	.04	.16E-01
*1050	0	0	1.13	.41
*1050	0	33	.30	.11
*1050	0	67	.09	.34E-01
*1050	0	133	.02	.67E-02
*1050	0	200	.03	.97E-02
1030	199	0	1.57	.57
*1030	199	33	.44	.16
*1030	199	100	.08	.31E-01
*1030	199	167	.01	.45E-02
*971	390	0	2.56	.93
2010	-398	0	2.49	.90
2040	-200	0	.82	.30
2050	0	0	1.04	.37
*2050	0	50	.30	.11
*2050	0	100	.12	.44E-01
*2050	0	200	.02	.63E-02
*2050	0	300	.01	.22E-02
2040	200	0	1.22	.44
2010	398	0	.52	.19
3426	-399	0	1.27	.46
3444	-200	0	.66	.24
3450	0	0	.98	.35
*3450	0	67	.26	.93E-01
*3450	0	200	.07	.24E-01
*3450	0	300	.02	.88E-02
*3450	0	400	.01	.25E-02
3444	200	0	1.00	.36
3426	399	0	.28	.10
5044	-232	0	.55	.20
5050	0	0	.63	.23
5050	0	67	.31	.11
5050	0	200	.06	.21E-01
5050	0	300	.02	.73E-02
5050	0	400	.00	.13E-02
5044	232	0	.68	.25
6650	0	0	.48	.17

Table 10-65

RUN NUMBER 36

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	170 SEC
WIND DIRECTION		45
WIND SPEED		9.8 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		850 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	9
WIND SPEED	.71 FT/S
STRATIFICATION	18 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	19.55	1.9
415	-163	0	16.68	1.6
450	0	0	14.01	1.4
415	163	0	20.53	2.0
317	298	0	18.53	1.8
971	-390	0	.78	.76E-01
1030	-199	0	.73	.71E-01
1050	0	0	.47	.46E-01
1030	199	0	.53	.51E-01
971	390	0	.53	.51E-01
2010	-398	0	.06	.62E-02
2040	-200	0	.21	.20E-01
2050	0	0	.34	.33E-01
2040	200	0	.32	.31E-01
2010	398	0	.32	.31E-01
2050	0	17	.24	.23E-01
2050	0	33	.36	.35E-01
2050	0	67	.56	.55E-01
2050	0	133	.01	.12E-02
2050	0	200	.16	.16E-01
3426	-399	0	.21	.20E-01
3444	-200	0	.28	.28E-01
3450	0	0	.29	.29E-01
3444	200	0	.33	.32E-01
3426	399	0	.05	.52E-02
5034	-400	0	.07	.67E-02
5046	-200	0	.13	.12E-01
5050	0	0	.07	.72E-02
5046	200	0	.21	.20E-01
5034	400	0	.11	.11E-01
6650	0	0	.18	.17E-01
0	0	0	0.00	0.

Table 10-66

RUN NUMBER 36V

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	170 SEC
WIND DIRECTION		45
WIND SPEED		9.8 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		850 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	5
WIND SPEED	.71 FT/S
STRATIFICATION	24 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	15.24	1.5
450	0	17	4.24	.41
450	0	33	1.21	.12
450	0	67	.56	.55E-01
450	0	133	.39	.38E-01
450	0	200	.17	.16E-01
1023	-232	0	1.05	.10
1023	-232	33	1.32	.13
1023	-232	100	.32	.31E-01
1023	-232	167	.11	.11E-01
1050	0	0	.72	.70E-01
1050	0	17	.88	.86E-01
1050	0	33	1.21	.12
1050	0	67	.56	.55E-01
1050	0	133	.35	.34E-01
1050	0	200	.20	.19E-01
1023	232	0	.29	.29E-01
1023	232	33	.80	.78E-01
1023	232	100	.54	.52E-01
1023	232	167	.28	.28E-01
2050	0	0	.43	.42E-01
3450	0	0	.47	.46E-01
3450	0	67	.32	.32E-01
3450	0	200	.19	.18E-01
3450	0	300	.03	.29E-02
3450	0	400	.01	.12E-02
5050	0	0	.19	.18E-01
5050	0	67	.15	.14E-01
5050	0	200	.15	.14E-01
5050	0	300	.06	.58E-02
5050	0	400	.02	.19E-02
6650	0	0	.22	.22E-01

Table 10-67

RUN NUMBER 36C

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	6
TIME EQUIVALENT	1	170 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION		45	STRATIFICATION	29 C
WIND SPEED		9.8 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION		STABLE	RELEASE GAS TEMP.	-175 C
BOIL OFF RATE		850 LBM/SEC	FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	13.20	1.3
415	-163	0	14.03	1.4
450	0	0	7.28	.71
*450	0	33	2.22	.22
*450	0	67	.25	.24E-01
*450	0	133	.09	.87E-02
*450	0	200	.04	.43E-02
415	163	0	11.84	1.2
317	298	0	6.81	.66
*971	-390	0	5.45	.53
1030	-199	0	8.50	.83
*1030	-199	33	.64	.62E-01
*1030	-199	100	.11	.11E-01
*1030	-199	167	.03	.26E-02
*1050	0	0	4.34	.42
*1050	0	33	2.14	.21
*1050	0	67	.62	.60F-01
*1050	0	133	.09	.84E-02
*1050	0	200	.04	.35E-02
1030	199	0	6.94	.68
*1030	199	33	1.96	.19
*1030	199	100	.05	.46E-02
*1030	199	167	.12	.12E-01
*971	390	0	0.00	0.
2010	-398	0	3.21	.31
2040	-200	0	6.56	.64
2050	0	0	4.96	.48
*2050	0	50	0.00	0.
*2050	0	100	.00	.25E-03
*2050	0	200	.00	.28E-03
*2050	0	300	.01	.12E-02
2040	200	0	4.98	.49
2010	398	0	3.58	.35
3426	-399	0	2.27	.22
3444	-200	0	3.18	.31
3450	0	0	3.96	.39
*3450	0	67	.15	.15E-01
*3450	0	200	.00	.23E-03
*3450	0	300	.03	.28E-02
*3450	0	400	.01	.14E-02
3444	200	0	2.39	.23
3426	399	0	3.38	.33
5044	-232	0	2.30	.22
5050	0	0	2.03	.20
5050	0	67	.43	.42E-01
5050	0	200	.04	.36E-02
5050	0	300	.01	.13E-02
5050	0	400	.00	.34E-03
5044	232	0	1.54	.15
6650	0	0	.42	.90E-01

Table 10-68

RUN NUMBER 236

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW	
DIKE MATERIAL	CONCRETE	SOIL	
TIME EQUIVALENT	1	170	SEC
WIND DIRECTION		45	
WIND SPEED		16.4	FT/S
STRATIFICATION		STABLE	
BOIL OFF RATE		850	LBM/SEC

MODEL CONDITIONS

SCALE	1-200	
GRID TYPE	9	
WIND SPEED	1.16	FT/S
STRATIFICATION	25	C
RELEASE GAS	40.6	MW
RELEASE GAS TEMP.	22	C
FLOW RATE	.80	CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	26.80	4.3
415	-163	0	25.87	4.1
450	0	0	22.01	3.5
415	163	0	27.88	4.4
317	298	0	20.82	3.3
971	-390	0	.44	.70E-01
1030	-199	0	.42	.67E-01
1050	0	0	.49	.78E-01
1030	199	0	.48	.76E-01
971	390	0	.49	.78E-01
2010	-398	0	.27	.43E-01
2040	-200	0	.33	.52E-01
2050	0	0	.35	.56E-01
2040	200	0	.31	.50E-01
2010	398	0	.39	.63E-01
2050	0	17	.45	.72E-01
2050	0	33	.70	.11
2050	0	67	.52	.84E-01
2050	0	133	.00	.43E-03
2050	0	200	.05	.82E-02
3426	-399	0	.15	.25E-01
3444	-200	0	.27	.43E-01
3450	0	0	.31	.50E-01
3444	200	0	.32	.51E-01
3426	399	0	.05	.82E-02
5034	-400	0	.01	.13E-02
5046	-200	0	.04	.65E-02
5050	0	0	0.00	0.
5046	200	0	.10	.16E-01
5034	400	0	.14	.22E-01
6650	0	0	.04	.65E-02
0	0	0	0.00	0.

Table 10-69

RUN NUMBER 336

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	170 SEC
WIND DIRECTION		45
WIND SPEED		23.0 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		850 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	9
WIND SPEED	1.62 FT/S
STRATIFICATION	24 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	39.95	8.9
415	-163	0	34.69	7.7
450	0	0	26.16	5.8
415	163	0	22.53	5.0
317	298	0	12.69	2.8
971	-390	0	.54	.12
1030	-199	0	.72	.16
1050	0	0	.84	.19
1030	199	0	.81	.18
971	390	0	.97	.22
2010	-398	0	.34	.75E-01
2040	-200	0	.48	.11
2050	0	0	.58	.13
2040	200	0	.58	.13
2010	398	0	.64	.14
2050	0	17	.66	.15
2050	0	33	1.06	.24
2050	0	67	.55	.12
2050	0	133	.56	.13
2050	0	200	0.00	0.
3426	-399	0	.29	.66E-01
3444	-200	0	.39	.87E-01
3450	0	0	.58	.13
3444	200	0	.76	.17
3426	399	0	.16	.36E-01
5034	-400	0	.16	.35E-01
5046	-200	0	.17	.39E-01
5050	0	0	.03	.70E-02
5046	200	0	.34	.76E-01
5034	400	0	.31	.69E-01
6650	0	0	.18	.41E-01
0	0	0	0.00	0.

Table 10-70

RUN NUMBER 336V

PROTOTYPE CONDITIONS			MODEL CONDITIONS	
DIKE CONFIGURATION		LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	SOIL	GRID TYPE	5
TIME EQUIVALENT	1	170 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION		45	STRATIFICATION	24 C
WIND SPEED		23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION		STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE		850 LBM/SEC	FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	13.71	3.0
450	0	17	2.23	.50
450	0	33	.87	.19
450	0	67	.72	.16
450	0	133	.22	.49E-01
450	0	200	.04	.86E-02
1023	-232	0	1.79	.40
1023	-232	33	1.32	.29
1023	-232	100	.58	.13
1023	-232	167	.10	.23E-01
1050	0	0	1.81	.40
1050	0	17	1.76	.39
1050	0	33	1.08	.24
1050	0	67	.68	.15
1050	0	133	.34	.75E-01
1050	0	200	.05	.11E-01
1023	232	0	1.58	.35
1023	232	33	.95	.21
1023	232	100	.48	.11
1023	232	167	.17	.37E-01
2050	0	0	.60	.13
3450	0	0	.64	.14
3450	0	67	.32	.70E-01
3450	0	200	.07	.17E-01
3450	0	300	.02	.36E-02
3450	0	400	.00	.11E-02
5050	0	0	.41	.92E-01
5050	0	67	.23	.50E-01
5050	0	200	.09	.20E-01
5050	0	300	.03	.69E-02
5050	0	400	.01	.13E-02
6650	0	0	.40	.88E-01

Table 10-71

RUN NUMBER 336C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION		LOW
DIKE MATERIAL	CONCRETE	SOIL
TIME EQUIVALENT	1	170 SEC
WIND DIRECTION		45
WIND SPEED		23.0 FT/S
STRATIFICATION		STABLE
BOIL OFF RATE		850 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	6
WIND SPEED	1.62 FT/S
STRATIFICATION	27 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-170 C
FLOW RATE	.80 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	13.99	3.1
415	-163	0	11.11	2.5
450	0	0	2.74	.61
*450	0	33	.78	.17
*450	0	67	.24	.52E-01
*450	0	133	.11	.26E-01
*450	0	200	.07	.15E-01
415	163	0	6.76	1.5
317	298	0	8.29	1.8
*971	-390	0	7.39	1.6
1030	-199	0	8.51	1.9
*1030	-199	33	1.20	.27
*1030	-199	100	.36	.81E-01
*1030	-199	167	.06	.13E-01
*1050	0	0	5.60	1.2
*1050	0	33	3.74	.83
*1050	0	67	1.04	.23
*1050	0	133	.12	.26E-01
*1050	0	200	.07	.17E-01
1030	199	0	5.78	1.3
*1030	199	33	2.00	.45
*1030	199	100	.09	.19E-01
*1030	199	167	.04	.97E-02
*971	390	0	2.02	.45
2010	-398	0	4.41	.98
2040	-200	0	7.16	1.6
2050	0	0	4.03	.90
*2050	0	50	1.14	.25
*2050	0	100	.19	.41E-01
*2050	0	200	.03	.76E-02
*2050	0	300	.00	.69E-03
2040	200	0	4.14	.92
2010	398	0	2.96	.66
3426	-399	0	2.95	.66
3444	-200	0	4.17	.93
3450	0	0	4.14	.92
*3450	0	67	.36	.79E-01
*3450	0	200	.01	.21E-02
*3450	0	300	.05	.11E-01
*3450	0	400	.02	.44E-02
3444	200	0	2.76	.61
3426	399	0	2.92	.65
5044	-232	0	3.25	.72
5050	0	0	3.12	.69
5050	0	67	.42	.94E-01
5050	0	200	.05	.13E-01
5050	0	300	.06	.14E-01
5050	0	400	.02	.41E-02
5044	232	0	2.22	.49
6650	0	0	2.02	.45

Table 10-72

RUN NUMBER 17

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	2
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	45	STRATIFICATION	0 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	275 LBM/SEC	FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	7.18	3.4
270	-130	0	7.69	3.6
300	0	0	.85	.40
270	130	0	3.45	1.6
187	234	0	2.12	1.0
702	-384	0	1.87	.88
775	-198	0	1.68	.79
800	0	0	.54	.25
775	198	0	.79	.37
702	384	0	.11	.51E-01
1343	-395	0	1.04	.49
1386	-200	0	.66	.31
1400	0	0	.37	.17
1386	200	0	.39	.18
1343	395	0	.22	.10
2367	-398	0	.30	.14
2392	-200	0	.33	.16
2400	0	0	.23	.11
2392	200	0	.03	.15E-01
2367	398	0	.11	.54E-01
3578	-399	0	.22	.10
3594	-200	0	.20	.93E-01
3600	0	0	.17	.81E-01
3594	200	0	.14	.66E-01
3578	399	0	.06	.30E-01
4984	-400	0	.12	.57E-01
4996	-200	0	.14	.66E-01
5000	0	0	.13	.63E-01
4996	200	0	.07	.33E-01
4984	400	0	.07	.33E-01
6000	0	0	.10	.48E-01
0	0	0	0.00	0.

Table 10-73

RUN NUMBER 17C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	9.8 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	275 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	10
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-165 C
FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	4.39	1.8
415	-163	0	4.24	1.8
450	0	0	2.96	1.2
415	163	0	3.64	1.6
317	298	0	3.15	1.3
1030	-199	0	1.94	.81
1030	199	0	1.58	.66
2010	-398	0	1.53	.64
2040	-200	0	1.37	.57
2050	0	0	.90	.38
2040	200	0	.76	.32
2010	398	0	.82	.34
3426	-399	0	1.07	.45
3444	-200	0	.59	.25
3450	0	0	.55	.23
3444	200	0	.01	.53E-02
3426	399	0	.53	.22
5044	-232	0	.29	.12
5050	0	0	.22	.93E-01
5050	0	67	.04	.16E-01
5050	0	200	.00	.11E-02
5050	0	300	0.00	0.
5050	0	400	0.00	0.
5044	232	0	.23	.96E-01
6650	0	0	.07	.29E-01

Table 10-74

RUN NUMBER 217

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	4
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION	45	STRATIFICATION	0 C
WIND SPEED	16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	275 LBM/SEC	FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	1.46	1.0
365	-163	0	2.41	1.7
400	0	0	.57	.40
365	163	0	.83	.59
267	298	0	.11	.74E-01
921	-390	0	.52	.36
980	-199	0	.88	.62
1000	0	0	.39	.28
980	199	0	.43	.30
921	390	0	.07	.52E-01
1960	-398	0	.45	.32
1990	-200	0	.38	.27
2000	0	0	.20	.14
1990	200	0	.17	.12
1960	398	0	.19	.13
2000	0	17	.20	.14
2000	0	33	.14	.97E-01
2000	0	67	.07	.52E-01
2000	0	133	0.00	0.
2000	0	200	.01	.37E-02
3376	-399	0	.30	.21
3394	-200	0	.21	.15
3400	0	0	.13	.93E-01
3394	200	0	.12	.82E-01
3376	399	0	.08	.56E-01
4984	-400	0	.11	.78E-01
4996	-200	0	.14	.97E-01
5000	0	0	.04	.30E-01
4996	200	0	.06	.45E-01
4984	400	0	.05	.33E-01
6600	0	0	.07	.52E-01
0	0	0	0.00	0.

Table 10-75

RUN NUMBER 317

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	23.0 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	275 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	4
WIND SPEED	1.62 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	.07	.71E-01
365	-163	0	.34	.35
400	0	0	.72	.74
365	163	0	.08	.82E-01
267	298	0	0.00	0.
921	-390	0	.03	.27E-01
980	-199	0	.32	.33
1000	0	0	.32	.33
980	199	0	.15	.16
921	390	0	.01	.54E-02
1960	-398	0	.06	.60E-01
1990	-200	0	.16	.17
2000	0	0	.14	.14
1990	200	0	.13	.14
1960	398	0	.02	.22E-01
2000	0	17	.15	.16
2000	0	33	.12	.13
2000	0	67	.09	.92E-01
2000	0	133	.03	.33E-01
2000	0	200	.01	.11E-01
3376	-399	0	.07	.71E-01
3394	-200	0	.09	.92E-01
3400	0	0	.09	.98E-01
3394	200	0	.08	.87E-01
3376	399	0	.05	.49E-01
4984	-400	0	.02	.16E-01
4996	-200	0	.03	.33E-01
5000	0	0	.02	.22E-01
4996	200	0	.04	.43E-01
4984	400	0	.02	.22E-01
6600	0	0	.04	.38E-01
0	0	0	0.00	0.

Table 10-76

RUN NUMBER 317C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	23.0 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	275 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	10
WIND SPEED	1.62 FT/S
STRATIFICATION	0 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-165 C
FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	2.83	2.9
415	-163	0	1.53	1.6
450	0	0	.21	.21
415	163	0	.43	.44
317	298	0	1.76	1.8
1030	-199	0	.41	.42
1030	199	0	.16	.16
2010	-398	0	.32	.33
2040	-200	0	.15	.15
2050	0	0	.08	.79E-01
2040	200	0	.09	.92E-01
2010	398	0	.27	.28
3426	-399	0	.15	.16
3444	-200	0	.11	.12
3450	0	0	.06	.65E-01
3444	200	0	.00	.36E-02
3426	399	0	.14	.14
5044	-232	0	.08	.79E-01
5050	0	0	.05	.50E-01
5050	0	67	.03	.28E-01
5050	0	200	.01	.75E-02
5050	0	300	.01	.72E-02
5050	0	400	.00	.37E-02
5044	232	0	.05	.48E-01
6650	0	0	.05	.48E-01

Table 10-77

RUN NUMBER 37

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	SOIL	GRID TYPE	9
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	45	STRATIFICATION	21 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	275 LBM/SEC	FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	3.00	.84
415	-163	0	6.97	1.9
450	0	0	8.11	2.3
415	163	0	5.55	1.5
317	298	0	5.88	1.6
971	-390	0	.16	.44E-01
1030	-199	0	.18	.51E-01
1050	0	0	.18	.50E-01
1030	199	0	.17	.48E-01
971	390	0	.12	.33E-01
2010	-398	0	.05	.14E-01
2040	-200	0	.05	.14E-01
2050	0	0	.05	.15E-01
2040	200	0	.05	.15E-01
2010	398	0	.08	.21E-01
2050	0	17	.10	.27E-01
2050	0	33	.14	.39E-01
2050	0	67	.18	.50E-01
2050	0	133	.13	.36E-01
2050	0	200	.07	.18E-01
3426	-399	0	.02	.61E-02
3444	-200	0	.03	.91E-02
3450	0	0	.04	.12E-01
3444	200	0	.03	.91E-02
3426	399	0	.01	.30E-02
5034	-400	0	.01	.29E-02
5046	-200	0	.01	.26E-02
5050	0	0	.02	.45E-02
5046	200	0	.04	.11E-01
5034	400	0	.02	.61E-02
6650	0	0	.03	.76E-02
0	0	0	0.00	0.

Table 10-78

RUN NUMBER 37C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	9.8 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	275 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	10
WIND SPEED	.71 FT/S
STRATIFICATION	29 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-165 C
FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	4.97	1.4
415	-163	0	5.10	1.4
450	0	0	1.56	.43
415	163	0	4.64	1.3
317	298	0	1.43	.40
1030	-199	0	2.87	.80
1030	199	0	2.44	.68
2010	-398	0	2.21	.61
2040	-200	0	1.98	.55
2050	0	0	1.49	.41
2040	200	0	1.35	.38
2010	398	0	1.42	.40
3426	-399	0	1.40	.39
3444	-200	0	1.31	.37
3450	0	0	1.07	.30
3444	200	0	1.00	.28
3426	399	0	1.14	.32
5044	-232	0	.86	.24
5050	0	0	.60	.17
5050	0	67	.20	.56E-01
5050	0	200	.02	.65E-02
5050	0	300	.01	.27E-02
5050	0	400	.01	.37E-02
5044	232	0	.68	.19
6650	0	0	.53	.15

Table 10-79

RUN NUMBER 237

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	16.4 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	275 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	9
WIND SPEED	1.16 FT/S
STRATIFICATION	25 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	5.82	2.6
415	-163	0	10.99	5.0
450	0	0	12.24	5.6
415	163	0	10.33	4.7
317	298	0	7.94	3.6
971	-390	0	.16	.73E-01
1030	-199	0	.14	.66E-01
1050	0	0	.19	.88E-01
1030	199	0	.16	.73E-01
971	390	0	.16	.73E-01
2010	-398	0	.10	.46E-01
2040	-200	0	.09	.41E-01
2050	0	0	.08	.38E-01
2040	200	0	.07	.31E-01
2010	398	0	.08	.38E-01
2050	0	17	.12	.56E-01
2050	0	33	.17	.75E-01
2050	0	67	.19	.88E-01
2050	0	133	.06	.28E-01
2050	0	200	.01	.62E-02
3426	-399	0	.02	.11E-01
3444	-200	0	.06	.28E-01
3450	0	0	.07	.31E-01
3444	200	0	.06	.28E-01
3426	399	0	.02	.11E-01
5034	-400	0	.00	.12E-02
5046	-200	0	.00	.12E-02
5050	0	0	.01	.62E-02
5046	200	0	.01	.62E-02
5034	400	0	.00	.12E-02
6650	0	0	.00	.12E-02
0	0	0	0.00	0.

Table 10-80

RUN NUMBER 337

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	23.0 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	275 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	9
WIND SPEED	1.62 FT/S
STRATIFICATION	26 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	.46	.29
415	-163	0	7.74	4.9
450	0	0	8.84	5.6
415	163	0	7.37	4.7
317	298	0	4.32	2.7
971	-390	0	.41	.26
1030	-199	0	.41	.26
1050	0	0	.53	.34
1030	199	0	.53	.34
971	390	0	.38	.24
2010	-398	0	.14	.92E-01
2040	-200	0	.22	.14
2050	0	0	.26	.16
2040	200	0	.22	.14
2010	398	0	.24	.16
2050	0	17	.29	.19
2050	0	33	.33	.21
2050	0	67	.19	.12
2050	0	133	0.00	0.
2050	0	200	0.00	0.
3426	-399	0	.09	.59E-01
3444	-200	0	.16	.99E-01
3450	0	0	.16	.10
3444	200	0	.20	.13
3426	399	0	.01	.84E-02
5034	-400	0	.02	.15E-01
5046	-200	0	.00	.17E-02
5050	0	0	0.00	0.
5046	200	0	.08	.48E-01
5034	400	0	.08	.48E-01
6650	0	0	.03	.18E-01
0	0	0	0.00	0.

Table 10-81

RUN NUMBER 337C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	SOIL
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	23.0 FT/S
STRATIFICATION	STABLE
BOIL OFF RATE	275 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	10
WIND SPEED	1.62 FT/S
STRATIFICATION	29 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-160 C
FLOW RATE	.28 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	2.62	1.7
415	-163	0	2.79	1.8
450	0	0	1.65	1.1
415	163	0	1.42	.90
317	298	0	1.45	.92
1030	-199	0	5.40	3.4
1030	199	0	2.73	1.7
2010	-398	0	3.29	2.1
2040	-200	0	4.12	2.6
2050	0	0	3.12	2.0
2040	200	0	2.55	1.6
2010	398	0	2.11	1.3
3426	-399	0	1.74	1.1
3444	-200	0	2.66	1.7
3450	0	0	2.31	1.5
3444	200	0	1.95	1.2
3426	399	0	1.51	.96
5044	-232	0	1.76	1.1
5050	0	0	2.07	1.3
5050	0	67	.41	.26
5050	0	200	.05	.33E-01
5050	0	300	.02	.14E-01
5050	0	400	.01	.89E-02
5044	232	0	1.67	1.1
6650	0	0	1.34	.85

Table 10-82

RUN NUMBER 18

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	CONCRETE
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	9.8 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	116 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	2
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	2.56	2.7
270	-130	0	2.88	3.0
300	0	0	.32	.33
270	130	0	.85	.90
187	234	0	.10	.11
702	-384	0	.39	.41
775	-198	0	.66	.70
800	0	0	.36	.38
775	198	0	.17	.18
702	384	0	.09	.94E-01
1343	-395	0	.22	.23
1386	-200	0	.19	.20
1400	0	0	.12	.13
1386	200	0	.11	.11
1343	395	0	.03	.33E-01
2367	-398	0	.06	.67E-01
2392	-200	0	.07	.74E-01
2400	0	0	.08	.80E-01
2392	200	0	.06	.67E-01
2367	398	0	.03	.33E-01
3578	-399	0	.08	.80E-01
3594	-200	0	.06	.60E-01
3600	0	0	.08	.80E-01
3594	200	0	.04	.47E-01
3578	399	0	.03	.33E-01
4984	-400	0	.05	.54E-01
4996	-200	0	.08	.87E-01
5000	0	0	.05	.54E-01
4996	200	0	.04	.47E-01
4984	400	0	.04	.40E-01
6000	0	0	.08	.80E-01
0	0	0	0.00	0.

Table 10-83

RUN NUMBER 18C

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	CONCRETE
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	9.8 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	116 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	10
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-130 C
FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	1.42	1.5
415	-163	0	1.64	1.7
450	0	0	1.42	1.5
415	163	0	1.61	1.7
317	298	0	.73	.77
1030	-199	0	.75	.79
1030	199	0	.47	.50
2010	-398	0	.39	.42
2040	-200	0	.38	.40
2050	0	0	.51	.54
2040	200	0	.31	.33
2010	398	0	.27	.28
3426	-399	0	.15	.16
3444	-280	0	.16	.17
3450	0	0	.18	.19
3444	280	0	0.00	0.
3426	399	0	.13	.14
5044	-232	0	.06	.63E-01
5050	0	0	.04	.39E-01
5050	0	67	.00	.18E-02
5050	0	200	0.00	0.
5050	0	300	0.00	0.
5050	0	400	0.00	0.
5044	232	0	.04	.39E-01
6650	0	0	.01	.82E-02

Table 10-85

RUN NUMBER 18C

PROTOTYPE CONDITIONS	
DIKE CONFIGURATION	LOW
DIKE MATERIAL	CONCRETE
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	9.8 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	116 LBM/SEC

MODEL CONDITIONS	
SCALE	1-200
GRID TYPE	10
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	16.0 MW
RELEASE GAS TEMP.	-130 C
FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	1.42	1.5
415	-163	0	1.64	1.7
450	0	0	1.42	1.5
415	163	0	1.61	1.7
317	298	0	.73	.77
1030	-199	0	.75	.79
1030	199	0	.47	.50
2010	-398	0	.39	.42
2040	-200	0	.38	.40
2050	0	0	.51	.54
2040	200	0	.31	.33
2010	398	0	.27	.28
3426	-399	0	.15	.16
3444	-200	0	.16	.17
3450	0	0	.18	.19
3444	200	0	0.00	0.
3426	399	0	.13	.14
5044	-232	0	.06	.63E-01
5050	0	0	.04	.39E-01
5050	0	67	.00	.18E-02
5050	0	200	0.00	0.
5050	0	300	0.00	0.
5050	0	400	0.00	0.
5044	232	0	.04	.39E-01
6650	0	0	.01	.82E-02

Table 10-85

RUN NUMBER 218

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	4
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION	45	STRATIFICATION	0 C
WIND SPEED	16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	.19	.35
365	-163	0	.45	.80
400	0	0	.45	.81
365	163	0	.18	.32
267	298	0	.05	.85E-01
921	-390	0	.04	.66E-01
980	-199	0	.24	.43
1000	0	0	.18	.33
980	199	0	.16	.28
921	390	0	.03	.47E-01
1960	-398	0	.06	.10
1990	-200	0	.14	.26
2000	0	0	.10	.18
1990	200	0	.06	.11
1960	398	0	.05	.94E-01
2000	0	17	.09	.16
2000	0	33	.05	.94E-01
2000	0	67	.06	.10
2000	0	133	0.00	0.
2000	0	200	.02	.28E-01
3376	-399	0	.07	.12
3394	-200	0	.08	.15
3400	0	0	.05	.85E-01
3394	200	0	.06	.10
3376	399	0	.04	.76E-01
4984	-400	0	.02	.28E-01
4996	-200	0	.03	.47E-01
5000	0	0	.01	.19E-01
4996	200	0	.04	.76E-01
4984	400	0	.03	.47E-01
6600	0	0	.04	.66E-01
0	0	0	0.00	0.

Table 10-86

RUN NUMBER 318

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	CONCRETE
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	23.0 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	116 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	4
WIND SPEED	1.62 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
267	-298	0	.02	.42E-01
365	-163	0	.06	.15
400	0	0	.37	.98
365	163	0	.03	.83E-01
267	298	0	0.00	0.
921	-390	0	0.00	0.
980	-199	0	.07	.19
1000	0	0	.15	.39
980	199	0	.05	.14
921	390	0	.02	.42E-01
1960	-398	0	.01	.14E-01
1990	-200	0	.07	.19
2000	0	0	.08	.21
1990	200	0	.05	.12
1960	398	0	.02	.55E-01
2000	0	17	.07	.19
2000	0	33	.05	.14
2000	0	67	.05	.12
2000	0	133	.03	.69E-01
2000	0	200	.02	.42E-01
3376	-399	0	.03	.69E-01
3394	-200	0	.04	.97E-01
3400	0	0	.02	.42E-01
3394	200	0	.04	.11
3376	399	0	0.00	0.
4984	-400	0	.01	.28E-01
4996	-200	0	.03	.69E-01
5000	0	0	.04	.11
4996	200	0	.03	.83E-01
4984	400	0	.02	.55E-01
6600	0	0	.02	.42E-01
0	0	0	0.00	0.

Table 10-87

RUN NUMBER 318V

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	CONCRETE
TIME EQUIVALENT	1000 SEC
WIND DIRECTION	45
WIND SPEED	23.0 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	116 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	5
WIND SPEED	1.62 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	.50	1.3
450	0	17	.52	1.4
450	0	33	.23	.60
450	0	67	.29	.76
450	0	133	.04	.11
450	0	200	.03	.82E-01
1023	-232	0	.14	.37
1023	-232	33	.09	.23
1023	-232	100	.03	.90E-01
1023	-232	167	.01	.27E-01
1050	0	0	.26	.68
1050	0	17	.23	.60
1050	0	33	.17	.46
1050	0	67	.11	.29
1050	0	133	.05	.12
1050	0	200	.04	.96E-01
1023	232	0	.15	.39
1023	232	33	.07	.17
1023	232	100	.08	.21
1023	232	167	.04	.11
2050	0	0	.15	.39
3450	0	0	.13	.35
3450	0	67	.08	.21
3450	0	200	.04	.10
3450	0	300	.03	.79E-01
3450	0	400	.00	.30E-02
5050	0	0	.09	.25
5050	0	67	.07	.19
5050	0	200	.01	.31E-01
5050	0	300	.00	.30E-02
5050	0	400	.01	.16E-01
6650	0	0	.08	.20

Table 10-88

RUN NUMBER 318C

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	10
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	45	STRATIFICATION	0 C
WIND SPEED	23.0 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	NEUTRAL	RELEASE GAS TEMP.	-165 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	2.08	5.5
415	-163	0	1.13	3.0
450	0	0	.14	.37
415	163	0	.30	.80
317	298	0	1.16	3.1
1030	-199	0	.29	.75
1030	199	0	.21	.54
2010	-398	0	.26	.69
2040	-200	0	.19	.49
2050	0	0	.12	.32
2040	200	0	.17	.45
2010	398	0	.20	.53
3426	-399	0	.22	.58
3444	-200	0	.16	.42
3450	0	0	.10	.26
3444	200	0	.00	.11E-01
3426	399	0	.13	.34
5044	-232	0	.11	.29
5050	0	0	.10	.25
5050	0	67	.03	.76E-01
5050	0	200	.01	.18E-01
5050	0	300	0.00	0.
5050	0	400	.00	.41E-02
5044	232	0	.08	.20
6650	0	0	.06	.16

Table 10-89

RUN NUMBER 38

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	9
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	45	STRATIFICATION	23 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	.07	.50E-01
415	-163	0	.71	.50
450	0	0	1.69	1.2
415	163	0	.82	.58
317	298	0	.42	.30
971	-390	0	.16	.12
1030	-199	0	.22	.16
1050	0	0	.25	.18
1030	199	0	.23	.17
971	390	0	.20	.14
2010	-398	0	.12	.69E-01
2040	-200	0	.15	.10
2050	0	0	.16	.12
2040	200	0	.14	.10
2010	398	0	.17	.12
2050	0	17	.18	.13
2050	0	33	.15	.11
2050	0	67	.06	.42E-01
2050	0	133	.01	.39E-02
2050	0	200	.01	.77E-02
3426	-399	0	.10	.69E-01
3444	-200	0	.13	.92E-01
3450	0	0	.13	.92E-01
3444	200	0	.13	.92E-01
3426	399	0	.07	.50E-01
5034	-400	0	.04	.27E-01
5046	-200	0	.08	.58E-01
5050	0	0	.06	.42E-01
5046	200	0	.10	.69E-01
5034	400	0	.08	.58E-01
6650	0	0	.08	.54E-01
0	0	0	0.00	0.

Table 10-90

RUN NUMBER 38V

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	5
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	45	STRATIFICATION	24 C
WIND SPEED	9.8 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	.29	.21
450	0	17	.19	.13
450	0	33	.05	.32E-01
450	0	67	.05	.32E-01
450	0	133	.05	.35E-01
450	0	200	.03	.19E-01
1023	-232	0	.02	.17E-01
1023	-232	33	.03	.23E-01
1023	-232	100	.03	.19E-01
1023	-232	167	.02	.12E-01
1050	0	0	.02	.13E-01
1050	0	17	.02	.17E-01
1050	0	33	.03	.24E-01
1050	0	67	.04	.28E-01
1050	0	133	.03	.20E-01
1050	0	200	.03	.21E-01
1023	232	0	.00	.17E-02
1023	232	33	.04	.31E-01
1023	232	100	.04	.26E-01
1023	232	167	.03	.25E-01
2050	0	0	.02	.16E-01
3450	0	0	.03	.18E-01
3450	0	67	.02	.16E-01
3450	0	200	.03	.21E-01
3450	0	300	0.00	0.
3450	0	400	.01	.81E-02
5050	0	0	.00	.17E-02
5050	0	67	.01	.84E-02
5050	0	200	.02	.15E-01
5050	0	300	.01	.41E-02
5050	0	400	.02	.18E-01
6650	0	0	0.00	0.

Table 10-91

RUN NUMBER 38C

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	10
TIME EQUIVALENT	1000 SEC	WIND SPEED	.71 FT/S
WIND DIRECTION	45	STRATIFICATION	29 C
WIND SPEED	9.8 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	-170 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	1.54	1.1
415	-163	0	3.09	2.2
450	0	0	1.73	1.2
415	163	0	2.34	1.7
317	298	0	1.32	.94
1030	-199	0	1.33	.94
1030	199	0	.92	.65
2010	-398	0	1.02	.73
2040	-200	0	.68	.48
2050	0	0	.56	.41
2040	200	0	.57	.41
2010	398	0	.57	.40
3426	-399	0	.60	.43
3444	-200	0	.53	.37
3450	0	0	.40	.28
3444	200	0	.39	.28
3426	399	0	.44	.31
5044	-232	0	.37	.26
5050	0	0	.29	.20
5050	0	67	.06	.43E-01
5050	0	200	.01	.73E-02
5050	0	300	.01	.70E-02
5050	0	400	.00	.18E-02
5044	232	0	.31	.22
6650	0	0	.28	.20

Table 10-92

RUN NUMBER 238

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	9
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.16 FT/S
WIND DIRECTION	45	STRATIFICATION	26 C
WIND SPEED	16.4 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	.06	.73E-01
415	-163	0	2.16	2.5
450	0	0	4.48	5.2
415	163	0	4.95	5.7
317	298	0	3.48	4.0
971	-390	0	.13	.15
1030	-199	0	.12	.14
1050	0	0	.15	.17
1030	199	0	.14	.16
971	390	0	.12	.13
2010	-398	0	.08	.91E-01
2040	-200	0	.10	.12
2050	0	0	.11	.12
2040	200	0	.10	.12
2010	398	0	.11	.13
2050	0	17	.13	.15
2050	0	33	.14	.16
2050	0	67	.09	.11
2050	0	133	.01	.61E-02
2050	0	200	.03	.30E-01
3426	-399	0	.06	.73E-01
3444	-200	0	.11	.12
3450	0	0	.13	.15
3444	200	0	.11	.12
3426	399	0	.03	.37E-01
5034	-400	0	.02	.24E-01
5046	-200	0	.04	.43E-01
5050	0	0	.04	.49E-01
5046	200	0	.08	.91E-01
5034	400	0	.09	.10
6650	0	0	.07	.85E-01
0	0	0	0.00	0.

Table 10-93

RUN NUMBER 338

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	9
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	45	STRATIFICATION	26 C
WIND SPEED	23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	.03	.55E-01
415	-163	0	.17	.27
450	0	0	.60	.97
415	163	0	.53	.86
317	298	0	.08	.13
971	-390	0	.16	.25
1030	-199	0	.18	.29
1050	0	0	.21	.34
1030	199	0	.23	.37
971	390	0	.21	.34
2010	-398	0	.06	.89E-01
2040	-200	0	.09	.15
2050	0	0	.13	.21
2040	200	0	.15	.24
2010	398	0	.13	.22
2050	0	17	.17	.27
2050	0	33	.20	.32
2050	0	67	.05	.81E-01
2050	0	133	.01	.13E-01
2050	0	200	0.00	0.
3426	-399	0	.07	.11
3444	-200	0	.11	.18
3450	0	0	.14	.23
3444	200	0	.13	.21
3426	399	0	.08	.12
5034	-400	0	.04	.72E-01
5046	-200	0	.04	.72E-01
5050	0	0	.04	.64E-01
5046	200	0	.09	.15
5034	400	0	.07	.11
6650	0	0	.09	.14
0	0	0	0.00	0.

Table 10-94

RUN NUMBER 338V

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	5
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	45	STRATIFICATION	24 C
WIND SPEED	23.0 FT/S	RELEASE GAS	40.6 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	22 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
450	0	0	.63	1.0
450	0	17	.20	.33
450	0	33	.05	.85E-01
450	0	67	.12	.20
450	0	133	.02	.30E-01
450	0	200	.01	.14E-01
1023	-232	0	.13	.21
1023	-232	33	.12	.19
1023	-232	100	.06	.10
1023	-232	167	.03	.43E-01
1050	0	0	.14	.23
1050	0	17	.13	.22
1050	0	33	.09	.15
1050	0	67	.07	.11
1050	0	133	.04	.62E-01
1050	0	200	0.00	0.
1023	232	0	.13	.21
1023	232	33	.09	.14
1023	232	100	.08	.12
1023	232	167	.01	.13E-01
2050	0	0	.10	.15
3450	0	0	.07	.11
3450	0	67	.04	.69E-01
3450	0	200	.02	.31E-01
3450	0	300	0.00	0.
3450	0	400	0.00	0.
5050	0	0	.02	.26E-01
5050	0	67	.01	.21E-01
5050	0	200	.02	.25E-01
5050	0	300	.01	.92E-02
5050	0	400	0.00	0.
6650	0	0	.03	.53E-01

Table 10-95

RUN NUMBER 338C

PROTOTYPE CONDITIONS		MODEL CONDITIONS	
DIKE CONFIGURATION	LOW	SCALE	1-200
DIKE MATERIAL	CONCRETE	GRID TYPE	10
TIME EQUIVALENT	1000 SEC	WIND SPEED	1.62 FT/S
WIND DIRECTION	45	STRATIFICATION	29 C
WIND SPEED	23.0 FT/S	RELEASE GAS	16.0 MW
STRATIFICATION	STABLE	RELEASE GAS TEMP.	-175 C
BOIL OFF RATE	116 LBM/SEC	FLOW RATE	.11 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
317	-298	0	2.26	3.6
415	-163	0	2.18	3.5
450	0	0	1.05	1.7
415	163	0	1.49	2.4
317	298	0	1.60	2.6
1030	-199	0	.93	1.5
1030	199	0	.92	1.5
2010	-398	0	.68	1.4
2040	-200	0	.63	1.0
2050	0	0	.38	.61
2040	200	0	.46	.75
2010	398	0	.51	.83
3426	-399	0	.53	.85
3444	-200	0	.36	.61
3450	0	0	.19	.30
3444	200	0	.20	.33
3426	399	0	.27	.43
5044	-232	0	.21	.33
5050	0	0	.10	.16
5050	0	67	.03	.47E-01
5050	0	200	.00	.42E-02
5050	0	300	.01	.10E-01
5050	0	400	.01	.13E-01
5044	232	0	.15	.24
6650	0	0	.05	.74E-01

Table 10-96

RUN NUMBER 19

PROTOTYPE CONDITIONS

DIKE CONFIGURATION	LOW
DIKE MATERIAL	SOIL CONCRETE
TIME EQUIVALENT G.T.10*5	G.T.10*5 SEC
WIND DIRECTION	45
WIND SPEED	9.8 FT/S
STRATIFICATION	NEUTRAL
BOIL OFF RATE	94 LBM/SEC

MODEL CONDITIONS

SCALE	1-200
GRID TYPE	2
WIND SPEED	.71 FT/S
STRATIFICATION	0 C
RELEASE GAS	40.6 MW
RELEASE GAS TEMP.	22 C
FLOW RATE	.09 CFM

SAMPLE POSITION (FT) X	Y	Z	PER CENT METHANE	CONCENTRATION COEFFICIENT K
187	-234	0	1.61	2.1
270	-130	0	1.55	2.0
300	0	0	.14	.18
270	130	0	0.00	0.
187	234	0	.07	.90E-01
702	-384	0	.07	.90E-01
775	-198	0	.30	.38
800	0	0	.24	.31
775	198	0	.08	.11
702	384	0	.02	.25E-01
1343	-395	0	.07	.90E-01
1386	-200	0	.12	.16
1400	0	0	.11	.15
1386	200	0	.09	.11
1343	395	0	.06	.82E-01
2367	-398	0	.04	.49E-01
2392	-200	0	.07	.90E-01
2400	0	0	.07	.90E-01
2392	200	0	0.00	0.
2367	398	0	.01	.16E-01
3578	-399	0	.05	.65E-01
3594	-200	0	.07	.90E-01
3600	0	0	.03	.41E-01
3594	200	0	.03	.41E-01
3578	399	0	.01	.82E-02
4984	-400	0	.01	.16E-01
4996	-200	0	.05	.65E-01
5000	0	0	.06	.74E-01
4996	200	0	.03	.41E-01
4984	400	0	.01	.16E-01
6000	0	0	.06	.74E-01
0	0	0	0.00	0.

Table 10-97